PROPOSAL FORM

BALTIMORE COUNTY
DEPARTMENT OF PUBLIC WORKS
TOWSON, MARYLAND

Division of Construction Contracts Administration

VOLUME 1

Architect
Hord Coplan Macht, Inc.
750 E. Pratt Street, Suite 1100
Baltimore, MD 21202
Phone: 410-837-7311
Fax: 410-837-6530

Structural Engineer
Faisant Associates, Inc.
810 Light Street, Suite 100
Baltimore, MD 21230
Phone: 410-783-1696
Fax: 410-783-1753

Civil Engineer
A. Morton Thomas & Associates, Inc.
800 King Farm Blvd, Fourth Floor
Rockville, MD 20850
Phone: 301-881-2545
Fax: 301-881-0214

Mechanical/Plumbing/Electrical Engineers
Burdette Koehler Murphy & Associates, Inc.
1416 Clarkview Road
Baltimore, MD 21209
Phone: 410-323-0600
Fax: 410-377-2543

IT Engineer
Wright Engineering, LLC
853 Ripple Stream Court
Joppa, MD 21085
Phone: 410-877-6297
Fax: 866-635-0374

Kitchen Consultant
Nyikos Associates, Inc.
18219A Flower Hill Way
Gaithersburg, MD 20879
Phone: 240-683-9530
Fax: 240-683-9532

Contract No. 15025 PO0
Property Management Project
(Silver) Leeds Certified Green Building – Eastern Family Resource Center
9150 Franklin Square Drive, Baltimore, Maryland 21237
Rosedale – District 14 c 6
Job Order No. 249-218-0100-0614

CONTRACT BASED ON FEBRUARY 2000
STANDARD SPECIFICATIONS FOR CONSTRUCTION & MATERIALS
AND STANDARD DETAILS FOR CONSTRUCTION, 2007

A pre-bid meeting will be held on Tuesday, July 21, 2015 at 10:00 a.m. EST in Room 118 of the Baltimore County Historic Courthouse, 400 Washington Avenue, Towson, Maryland 21204.

First Advertisement: July 2, 2015

****

Cost: $75.00

PROPOSAL OF _____

_____

_____

CONTRACT NO. 15025 PO0

THIS PROPOSAL FORM INCLUDES AND INCORPORATES ALL DOCUMENTS AND INFORMATION REFLECTED, LISTED, AND/OR REFERENCED IN THIS TABLE OF CONTENTS, AND ALL SUCH DOCUMENTS AND INFORMATION ARE PART OF AND INCORPORATED INTO THE CONTRACT DOCUMENTS.

TABLE OF CONTENTS

VOLUME 1

SECTION I

INFORMATION FOR BIDDERS

Sealed proposals, addressed to Baltimore County, Maryland for capital construction contracts and incidentals thereto, in the below-noted proposal forms & as shown on drawings ***(drawings may be in hard copy or CD format)*** on file in the office of the Director of Public Works, Towson, MD 21204, will be received in Rm.148, Old Courthouse, 400 Washington Avenue, Towson, MD 21204, on the date & at the time specified on the Job Description page of the Proposal, at which time and place they will be publicly opened & read.

Refer to the enclosed proposal sheets for quantities to be bid upon. All proposals submitted on the attached form must give the price in clear figures for each item of the proposed work and be signed by the bidder with his name and address. Bidders must not change any item in the proposal for which a price has been stipulated by the County. Any change will cause rejection of the proposal.

Each proposal book must be submitted in a sealed envelope, plainly marked to indicate its contents, or in an envelope furnished by the County. All blank spaces on the County envelope must be completely filled in so as to clearly indicate its contents.

NOTE: STATEMENT UNDER OATH FORM TO ACCOMPANY BID as per Baltimore County Purchasing Act 65-98, Section 15-94 and 15-95 which requires that the enclosed affidavit (see Proposal Affidavit pages in Section V) be completed and submitted as part of the sealed bid.

Proposals made on any other than the attached form will not be considered. All papers included in, bound thereto, or attached to the Proposal Form are necessary parts thereof and shall not be detached, separated, or altered in their intent.

THE PROPOSAL BOOKLET IS TO BE SUBMITTED IN ITS ENTIRETY.

Changes in the phraseology of the proposal, additions, or limiting provisions will render the proposal informal or void and may cause its rejection.

All right is hereby reserved by the Purchasing Agent to reject any or all proposals and to waive formalities and technicalities as the interest of the County may require.

No successful bidder may withdraw his bid within **NINETY (90)** days after the opening thereof.

Additional Plans *(plans may be in hard copy or CD format)*, Specifications and/or contract documents may be obtained at the office listed below for the cost as stated in the advertisement. No refunds will be made to anyone.

Division of Construction Contracts Administration
Bureau of Engineering & Construction
Baltimore County Office Building – Room 300 B
111 W. Chesapeake Avenue
Towson, Maryland 21204

The successful bidder will be required to be bonded to Baltimore County, Maryland to the sum of One Hundred per Cent (100%) of the amount of his proposal or proposals according to the form of bond hereto attached for projects in excess of $25,000.00.

This Proposal must be accompanied by a Bid Bond in an amount of 5% of the bid, the exact amount to be determined by the difference between the low bid and the next lowest bid if two or more bids are received, or 5% of the bid if one bid is received. This guarantees payment of the amount thus determined in case of a default in any matter specified as required before award or in any matter resulting in failure to execute and deliver an Agreement, together with Payment and Performance Bonds, after award. The Bid Bond must be in the form accompanying the Proposal executed by a Surety licensed in the State of Maryland. The Surety must be currently rated "B" or better by the A. M. Best Company, and the bid must be in an amount less than, or equal to, the underwriting limitation contained in Department of Treasury Circular 570 as amended at the time of the underwriting.

All work to be performed under this contract shall be done under strict compliance with **Baltimore County Department of Public Works February 2000 Standard Specifications for Construction and Materials and April 2007 Standard Details for Construction and any and all proposed revisions** thereto as of the date of advertisement and copies of which are on file and available in the Division of Construction Contracts Administration, County Office Building, Towson, Maryland, and all of which are made a part hereof and incorporated herein (collectively, the "Specifications").

If the bidder to whom an award is made shall fail to execute the contract and bond hereto attached and as herein provided, the award may be annulled and the contract awarded to the lowest responsible bidder who has consented to a time extension, and such bidder shall fulfill every stipulation embraced herein as if he were the original party to whom the award was made, or the Purchasing Agent may reject all of the bids as the interest of the County may require.

The Bid Bond of the three lowest bidders is deemed to be effective until the execution and delivery of the Contract Agreement, together with Payment and Performance Bonds for projects in excess of $25,000.00 or until rejection of all bids, whereupon Surety is deemed relieved of all further obligations under the bid bonds provided.

Bidders must examine the drawings and specifications carefully and must make a personal examination of the location and nature of the proposed work. In case doubt shall arise as to the meaning or intent of anything shown on the drawings or comprised in the specification, inquiry shall be made of the Director of Public Works at least 5 days prior to the date of bid opening. The submission of the Proposal shall indicate that the bidder thoroughly understands the drawings and the terms of the Specifications.

To better insure fair competition and to permit a determination of the lowest bidder, unresponsive bids or bids obviously unbalanced may be rejected by the Purchasing Agent.

Bidders are required to fill out the total price column and total their proposals so that the result of the bidding, barring possible arithmetical errors, will be known at once. Any errors in computations will be corrected by the Engineer when the proposals are canvassed. Where the unit price and the total price are at variance, the unit price will prevail.

Bidders must be prepared to complete the work within the time stated in the proposal.

NOTE: ONLY CONTRACTORS FORMALLY PRE-QUALIFIED WITHIN THE ADVERTISED WORK CLASSIFICATION BY THE DIRECTOR OF PUBLIC WORKS OF BALTIMORE COUNTY 10 CALENDAR DAYS PRIOR TO BID OPENING WILL BE ELIGIBLE TO SUBMIT BIDS.

Contracts for work under this proposal will obligate the contractors and subcontractors not to discriminate in employment practices. Bidders must, if requested, submit a compliance report concerning their employment practices and policies in order to maintain their eligibility to receive the award of the contract. Successful bidders must be prepared to comply in all respects with the Contract Provisions regarding nondiscrimination.

Baltimore County has adopted a Minority Business Enterprise (MBE) program and Women's Business Enterprise (WBE) Program. The percentage of participation applies to the contract amount awarded to the Contractor. Qualified minority subcontractors are those certified as being a Minority Business Enterprise by the following:

1. Maryland Department of Transportation Certification Committee (MDOT)

2. City of Baltimore, Minority Business Certification Council

Projects funded by the Federal Highway Administration are limited to the certification listed under #1 (MDOT).

More detailed information regarding the County's MBE/WBE Program can be obtained from the County MBE Office, telephone (410) 887-3407. See Executive Order dated June 4, 2009. MBE/WBE Participation Summary and Forms A, B, C, D and E enclosed in this proposal booklet.

NOTE: If you do not complete and submit the enclosed forms with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer **NON-RESPONSIVE** and accordingly the **COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD**.

The County reserves the right to require the low bidder to produce evidence indicating that the company's financial condition is equal to, or better than, that enjoyed by the company at the time of prequalification. This additional information may be in the form of a financial statement or other evidence satisfactory to the Office of Budget & Finance.

Bidders' attention is directed to the requirement that a permit must be obtained from the Baltimore County Bureau of Highways & Traffic prior to cutting any County road for the purpose of obtaining sub-surface soils information, and permission must be obtained from the State Highways Administration prior to making any openings in a State road.

Under no circumstances shall a bidder enter upon any property outside a County or State road for the purpose of securing sub-surface soils information until permission is received from the property owner. The fact that the County has obtained a utility easement does not give the bidder the right to enter upon the property.

Prevailing index price of asphalt cement/ton **$486.25**.

INCLEMENT WEATHER POLICY:

If Baltimore County General Government Offices are open or open with liberal Leave the day the bids are due, the bids are due as stated in the bid documents (date and time).

ONLY when the Baltimore County General Government Offices are **OFFICIALLY CLOSED** the day the bids are due, the bid date will be postponed and an Addendum will be issued the next business (or next day buildings are officially open) day the county offices are open with the new bid date and time.

SECTION II

Interim Supplemental Specifications to the Standard Specifications for Construction and Materials

This contract shall include by reference the documents known as Supplemental Specifications, the contents of which shall be incorporated in their entirety herein and are in effect for all contracts bid after February 5, 2013:

1. General Conditions Building Projects, last revised March 2010.

2. Addendum 3 to the February 2000 *Standard Specifications for Construction and Materials* and *Standard Details for Construction*.

3. #1. and #2. are collectively known as the "Supplemental Specifications."

4. ***Revised General Provisions Pages (14A-123) and Terms and Conditions (TC) Pages (124-136A).**

In the event of a conflict between the Supplemental Specifications and the February 2000 *Standard Specifications for Construction and Materials* and *Standard Details for Construction*, the Supplemental Specifications shall control.

These documents are subject to change and amendment. It is the responsibility of the parties to this contract to be aware of these Supplemental Specifications. These documents are available for review either (1) at the Department of Public Works, Division of Construction Contracts Administration, County Office Building, Room 300B, 111 West Chesapeake Avenue, Towson, MD, 21204 – Phone (410) 887-3531 or (2) on our website at www.baltimorecountymd.gov/Agencies/publicworks/standardsandspecs/specsanddetails.html

- REVISION to **GP-7.11 Preservation and restoration of Property**, Paragraph (a) of the Standard Specifications Pages 65 and 66.
    a. The Contractor shall not enter upon public or private property (out-side of the right-of-way or project area) for any purpose without obtaining written permission and he/she shall be responsible for the preservation of all public and private property, trees, monuments, signs and markers and fences thereon, and shall use every precaution necessary to prevent damage or injury thereto. The Contractor shall take suitable precaution to prevent damage to underground or overhead public utility structures. **THE CONTRACTOR SHALL PROTECT CAREFULLY FROM DISTURBANCE OF ALL LAND MONUMENTS AND PROPERTY MARKS LOCATED ON THE CONTRACT DRAWINGS OR FOUND IN THE FIELD. IF DAMAGED OR DISTURBED THEY SHALL BE RESET BY A LICENSED SURVEYOR AT THE CONTRACTORS EXPENSE.**

- REVISON to **GP 7.29 MINORITY BUSINESS ENTERPRISE AND AFFIRMATIVE ACTION** of the Standard Specification Pages 75 to 82 and Pages 10 and 11 of Addendum #3 of the Standard Specifications.

- **GP 7.29.01 County Policy**: It is the policy of the County that MBE's and WBE's, as defined by the most recent County Executive Order and as further described in the Contract Documents, shall have the maximum opportunity to participate in the performance of capital improvement contracts financed by County capital funds and/or County operating funds, in accordance with the most recent County Executive Order. The Contractor shall comply with all MBE/WBE requirements as set forth in the Contract Documents.

- **GP 7.29.02 through 7.29.25**: Superceded by Executive Order Dated June 4, 2009.

- ADDITION to **Section 303.03, Pipe Culvert Construction** of the *Standard Specifications*, Page 227, requiring inspection of interiors of new sewers 12" or larger in diameter with closed circuit TV cameras:

303.03.10 TV Inspection. Contractors shall be required to conduct closed circuit television (CCTV) internal inspections of all new storm drain and culvert construction 12" and larger in diameter or span. This inspection will document and identify any system defects and provide the County with a record of the condition of the storm drain at completion of construction.

The entire length of the pipe shall be shown, and close-up views taken of the entire inner circumference of each pipe joint. Structures occurring along the pipeline shall also be examined on each interior face. Whenever possible, TV inspection shall be done under conditions of minimum or no flow within the pipe system.

The CCTV inspections shall be performed in accordance with *Specification Guidelines: Wastewater Collection Systems Maintenance and Rehabilitation* prepared by the National Association of Sewer Service Companies (NASSCO) and the *Handbook: Sewer Infrastructure Analysis and Rehabilitation*, EPA/625/6-91/030, October, 1991.

The CCTV records, including all logs, photographs and videotape/DVD records, shall be provided to Baltimore County's Bureau of Engineering and Construction, Storm Drain Design Section, for review prior to final acceptance of the construction. Upon, approval, the tapes will be forwarded to the Bureau of Utilities for their use.

- ADDITION to **Section 1007.03.02, Acceptance Testing** of the *Standard Specifications*, Page 759, requiring inspection of interiors of new sewers 8" or larger in diameter with closed circuit TV cameras:

> **(e) TV Inspection.** Contractors shall be required to conduct closed circuit television (CCTV) internal inspections of all new sewer construction of 8" and larger pipelines. This inspection will document and identify any system defects and provide the County with a record of the condition of the sewer at completion of construction.
>
> The CCTV inspections shall be performed in accordance with *Specification Guidelines: Wastewater Collection Systems Maintenance and Rehabilitation* prepared by the National Association of Sewer Service Companies (NASSCO) and the *Handbook: Sewer Infrastructure Analysis and Rehabilitation*, EPA/625/6-91/030, October, 1991.
>
> The CCTV records, including all logs, photographs and videotape/DVD records, shall be provided to Baltimore County's Bureau of Engineering and Construction, Sewer Design Section, and the Bureau of Utilities for review prior to final acceptance of the construction.

The following changes are made to page 6 of the Consolidated ADDENDUM (#3) to the *Standard Specifications for Construction and Materials* dated February, 2007:

Section GP-2.20 Tie Bids, page 34, (b) Award, last sentence, replace County Code Section in brackets with new numbered reference:

For further options on the bids and the definition of a qualified minority, refer to Baltimore County Code, [Section 15-84(6)] Section 10.2-406(d)(1).

Revise Section 901.01, Aggregates, page 601:
This section covers the material details, quality requirements and test methods applicable to aggregates. Grading requirements are outlined in Tables 901A and 901C; Physical properties in 901 B and 901 D. Force drying may be used in the preparation of samples for grading tests conducted in the field. ***Quarries providing material to Baltimore County Projects must be approved by Maryland State Highway Administration and listed in the current MDSHA Aggregate Bulletin.***

Revise Section 902.10.03, Portland Cement Concrete Mixtures, page 618:
All Portland Cement Concrete mix designs used on Baltimore County projects must have been approved by the Maryland State Highway Administration (MDSHA). The MDSHA mix design approval number must be included on all load tickets. The concrete mixes shall conform to the following:

Revise Section 904.04.02, Mix Design, page 632:
The contractor shall develop a Superpave mix design in conformance with R35. ***All HMA material used on Baltimore County projects must be Maryland State Highway Administration (MDSHA) approved mixes.*** HMA Superpave mixes shall conform to the specification for Superpave Volumetric Mix Design, M323, and shall be designed for Equivalent Single Axle Loading (ESAL) range specified in the Contract Documents.

The contractor may elect to use...

Revise Section 915.01.01, Approval, page 675:
The plant from which the Contractor proposes to obtain material **[will be approved by the Regional Engineer before starting deliveries.]** ***to be used on Baltimore County projects must have been approved by the Maryland State Highway Administration (MDSHA).***

Revise Section 915.02, HOT MIX ASPHALT (HMA) PLANTS, page 678:
All plants ***providing HMA material to Baltimore County projects must be approved by Maryland State Highway Administration (MDSHA) and*** **conform to M 156 except as modified in 915.01 and the following:**

Revise Section 915.03.05, Certified Concrete Plant, page 681:
Concrete plants providing material to Baltimore County Projects must be certified by the Maryland State Highway Administration (MDSHA) and must satisfy all criteria outlined in the Maryland Standard Specifications for Construction and Materials (latest edition). The producer shall be responsible for quality control of plant operations to assure that the material conforms to Specification requirements. The quality control process will be subject to unannounced periodic inspection by representatives of the Regional Engineer. Full participation in the inspection by the plant's certified technician will be required.

The following changes are made to the "Sanitary Sewer Details Index Sheet, Standard Detail S-3, and Roads and Streets Details Index Sheet" of the Consolidated ADDENDUM (#3) to the Standard Details for Construction dated February, 2007.

7 D Sanitary Sewer Details Index Sheet

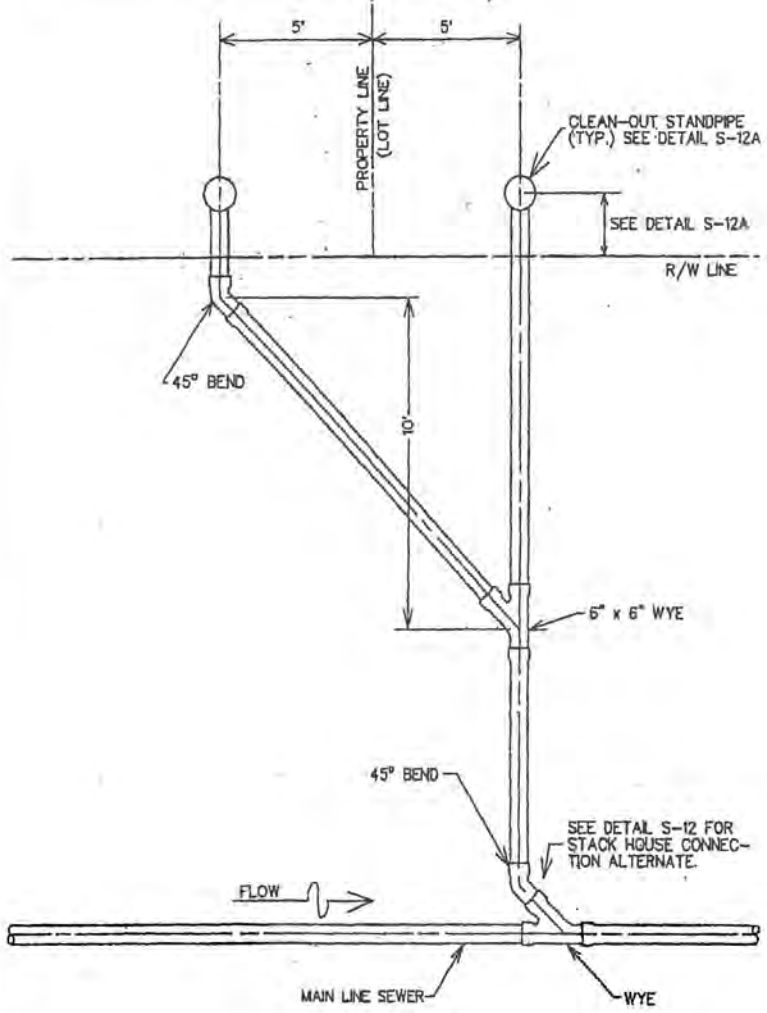
7 E Standard Detail S-3

7 F Roads and Streets Details Index Sheet

Sanitary Sewer Standard Details

PLATE #	TITLE	SIGNATURE DATE	STD. SPECS. REFERENCE	COMMODITY CODE
S-1	Manhole	3/10/2005	1008	870000
S-2	Shallow Manhole	3/10/2005	1008	872190
S-3	Twin House Conn. Layout	3/18/2002	1007	-
S-4	Precast 48" San.MH	1/2/2007	1008	875000
S-5	60", 72" Precast San. MH	1/2/2007	1008	875000
S-6	Drop MH - Type A & B	3/18/2002	1008	880000, 881000
S-6A	Precast San.Drop MH	12/4/2001	1008	880000, 881000
S-7	Bedding/Gravity PVC Pipe	1/31/2007	1001	-
S-8	Heavy Traffic MH Fr.&Cvr	10/23/1997	1008	877000
S-8B	Sanitary MH Platen Cover – 1	9/12/2000	1008	877000
S-8C	Sanitary MH Platen Cover – 2	9/12/2000	1008	877000
S-12	Stack House Connections	10/23/1997	1007	-
S-12A	House Conn.@ Prop.Line	1/10/2007	1007	-
S-12B	Grinder Pump Conn@Hse.Conn.	1/2/2007	-	-
S-13	Watertight MH Fr.&Cvr	10/23/1997	1008	877000
S-14	Air Relief Valve Vault	3/18/2002	Special Provision	886000
S-15	Precast Doghouse Riser	5/15/2002	1008	-

NOTE: TWIN CONNECTION MAY BE USED ON TOWNHOUSES ONLY. ANY OTHER USE MUT BE APPROVED BY THE DIRECTOR OF PUBLIC WORKS.



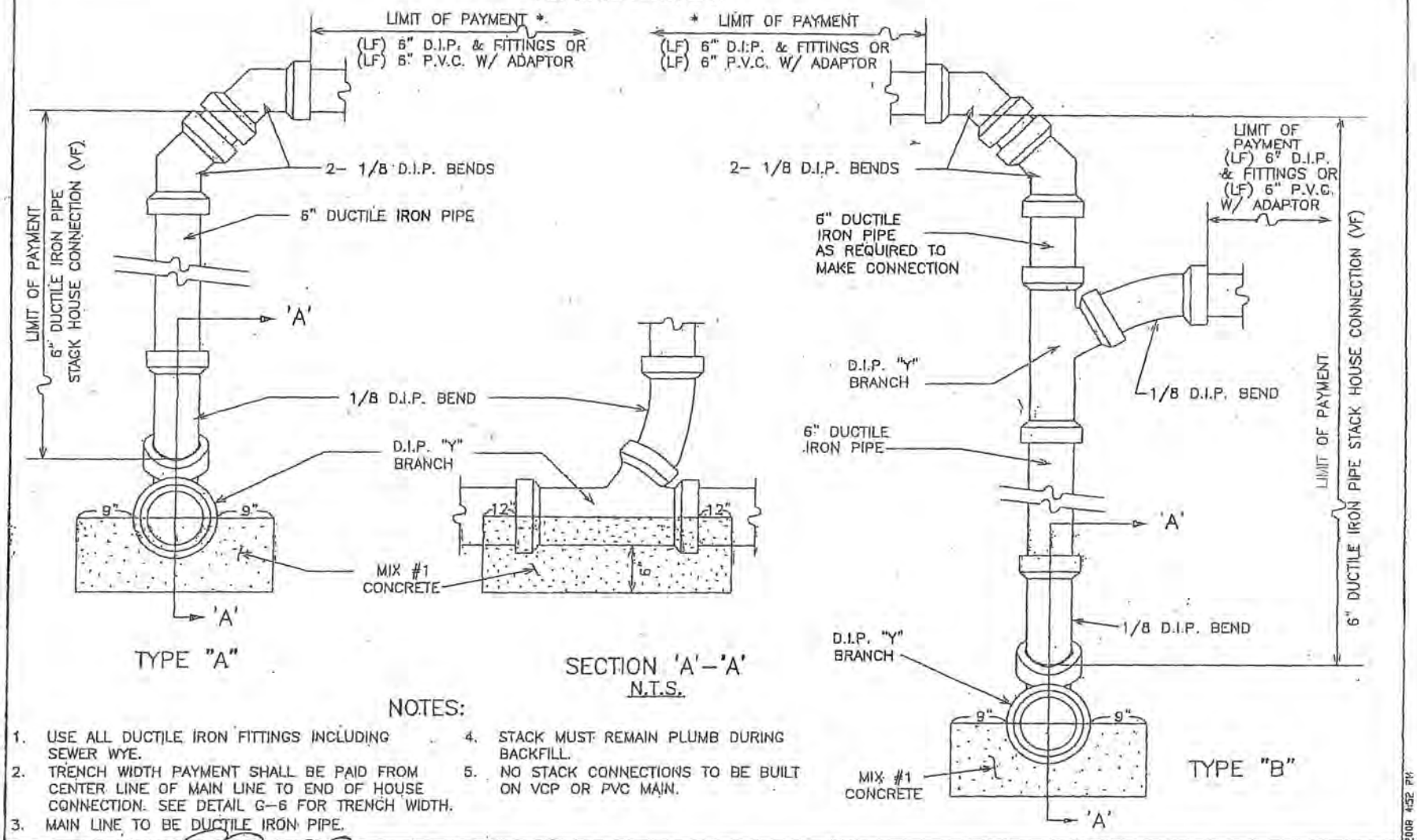
APPROVAL
DIRECTOR
BUR. OF ENGINEERING/CONSTRUCTION
3/18/82
DATE

DEPARTMENT OF PUBLIC WORKS
SANITARY SEWER DETAIL

TWIN HOUSE CONNECTION LAYOUT

ISSUED: AUGUST, 1997
REVISED: FEBRUARY, 2002
REVISED:

PLATE
S-3



NOTES:

1. USE ALL DUCTILE IRON FITTINGS INCLUDING SEWER WYE.
2. TRENCH WIDTH PAYMENT SHALL BE PAID FROM CENTER LINE OF MAIN LINE TO END OF HOUSE CONNECTION. SEE DETAIL G-6 FOR TRENCH WIDTH.
3. MAIN LINE TO BE DUCTILE IRON PIPE.
4. STACK MUST REMAIN PLUMB DURING BACKFILL.
5. NO STACK CONNECTIONS TO BE BUILT ON VCP OR PVC MAIN.

BALTIMORE COUNTY MARYLAND

APPROVAL

DIRECTOR
BUR. OF ENGINEERING/CONSTRUCTION
10/31/13
DATE

DEPARTMENT OF PUBLIC WORKS
SANITARY SEWER DETAILS

STACK HOUSE CONNECTIONS

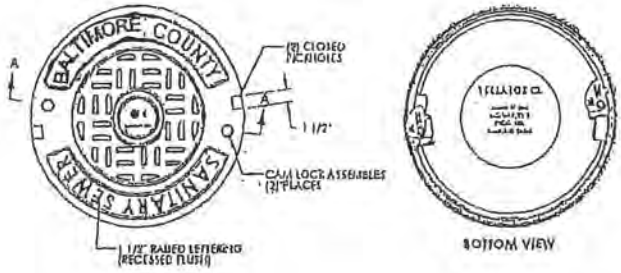
ISSUED: OCTOBER 1977
REVISED: AUGUST 1997
REVISED: JUNE 2013
REVISED: MAY 5, 2014
PLATE
S-12

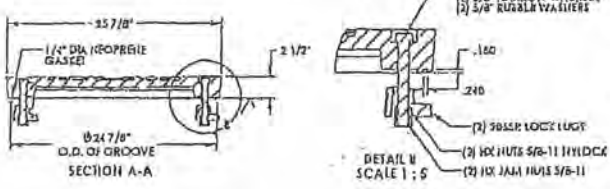
12A

PLATEHOR.DWG 6/13/2008 4:52 PM

Maryland 24" x 9" Straight Wall Frame with Scalloped Flange & Water Tight BALTIMORE COUNTY County Sanitary Sewer Cover with Cam Lock

1545A1GS Assembly



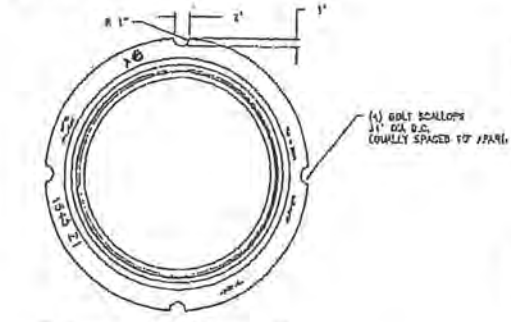


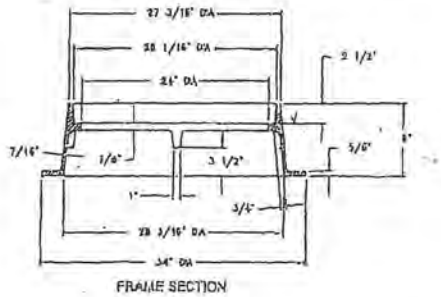
00154548
Quantity: 1

For In-Roadway Use
Or Approved Equal.

Supersedes Detail S-13

1545Z1 Frame





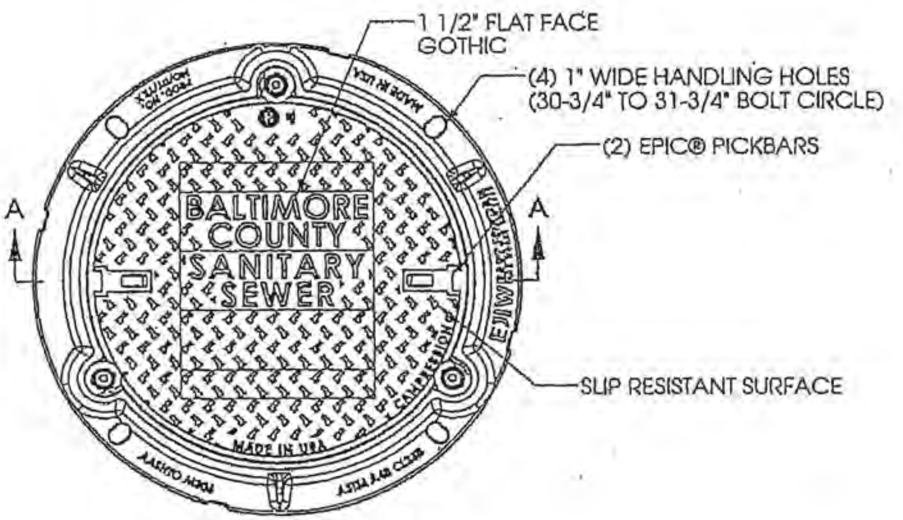
00154512
Quantity: 1

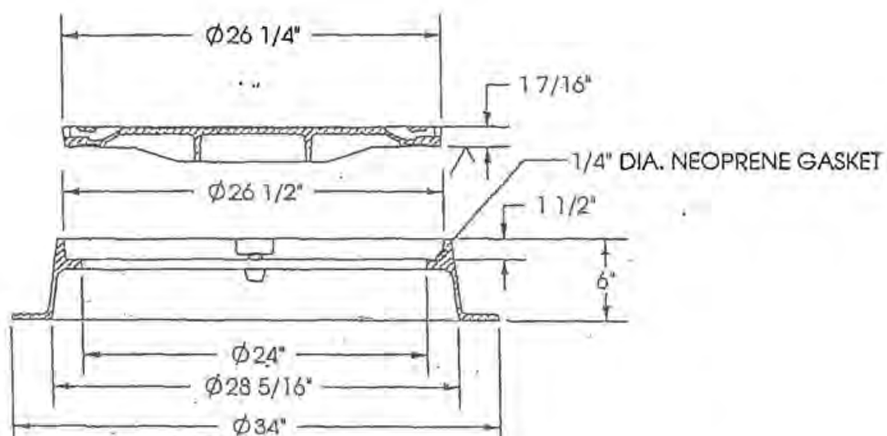
Contact
800 626 4653
ejco.com

CAMPRESSION Assembly

For outside of roadway use.
Or Approved Equal.

Supersedes Detail S-13





SECTION A-A

PRELIMINARY

Submittal Number
NPR14-954A

Design Features
-Materials
Frame
Gray Iron (CL35B)
Cover
Ductile Iron (70-50-05)

-Design Load
Heavy Duty
-Open Area
n/a
-Coating
Undipped
-√ Designates Machined Surface

12C

Certification
-ASTM A48
-ASTM A536

-Country of Origin: USA

Major Components
WT-12339011
WT-12339048

Drawing Revision
2/10/2014 Designer: MAH
Revised By:

Disclaimer
Weights (lbs/kg), dimensions (inches/mm) and drawings provided for your guidance. We reserve the right to modify specifications without prior notice.

Contact
800 626 4653
ejco.com

Roads and Streets Standard Details

PLATE #	TITLE	SIGNATURE DATE	STD. SPECS. REFERENCE	COMMODITY CODE
R-1	Pri.Rd.Paving Sections	11/21/2000	501, 504	-
R-2A	Subdiv.Paving Sect.(CBR≥5)	3/10/2005	501, 504	-
R-2B	Subdiv.Paving Sect.(CBR<5)	3/10/2005	501, 504	-
R-10	20'St.(40'R/W)-No Pkg.	10/23/1997	-	-
R-11	22'St.(40'R/W)-No Pkg.	10/23/1997	-	-
R-12	28'St.(50'R/W)-Pkg.1 Side	11/24/1999	-	-
R-13	30'St.(50'R/W)-Pkg.1 Side	11/24/1999	-	-
R-14	Concrete Alleys	2/22/2006	520	561100
R-14A	Concrete Alleys	11/24/1999	520	387404, 387120, 390500
R-15	Drive Entr.-No Curb	10/23/1997	501, 504	520114, 530300
R-15A	Drive Entr-Sdwk/Curb Var	2/22/2006	520	561100
R-15B	Drive Entr-SdwkAbutsCurb	2/22/2006	520	561100
R-17	Concrete Alley Joints	11/24/1999	520	561100
R-18	Alley Entrance	2/22/2006	520	561100
R-19	Std.4'Sidewalk	2/22/2006	610	855000
R-20A	H.M.A. Mountable Curb	11/24/1999	609.03.02	615581
R-20B	Extr.Conc.Mount.Curb	10/23/1997	609	615591, 2
R-21	7"Comb.Curb & Gutter	2/22/2006	609	630000, 616000
R-22	Underdrain-Paved Streets	12/4/2001	306	387000, 390500
R-23	Conc.Ditch to Curb & Gtr	2/22/2006	609, 307	631000, 630000
R-24	Concrete Curb	12/20/2002		
R-27	Barricades	10/23/1997	612, 918	859000
R-28	Svce.Station Entr.Chnlz	2/22/2006	520	-
R-29	Svce.Sta.Entr.@Intersect	2/22/2006	520	-
R-30	Commercial Entr.Chnlzn	2/22/2006	520	-
R-31	Comm.Entr.@Intersection	2/22/2006	520	-
R-32	Single Commercial Entr	1/2/2007	520	-
R-32A	Rural Commercial Entr	10/23/1997	501, 504, 303	-
R-33	Valley Gutter-90Deginter.	1/2/2007	520	631010
R-35	Accel.Lane(Min.Widening)	10/23/1997	-	-
R-35A	Accel.Lane(Widened to PL)	10/23/1997	-	-
R-36A	Ped.Ramp/Median/Depressed	12/20/2002	-	-
R-36B	Truncated Pedestrian Ramp	12/20/2002	-	-
R-36C	Detectable Warnings	12/20/2002	-	-
R-36D	Median/Island Ped.Passage	12/20/2002	-	-
R-36E	Pedestrian Bump-Out	12/20/2002	-	-
R-37	7"Valley Gutter/Perp.Pkg	2/22/2006	520	631010
R-38	Flexible Pvg.of Trenches	3/18/2002	505	120550, 61, 63
R-39	Adjusting Utility Frame	10/23/1997	305, 508	590110, 20
R-41	Pavement Failure Repairs	11/24/1999	505	590600, 5
R-42	Hot-Mix Asphalt Paving	10/23/1997	504	556380

1001.05 STEEL PLATES

If the Contractor elects to bridge a trench or open cut excavation within paved areas of the Construction area with steel plates, it shall notify the Engineer forty-eight (48) hours in advance of placement of any steel plate(s). If multiple plate(s) are required to cover an open cut excavation, the Contractor shall also submit a detailed plan to the Engineer showing the placement of all steel plate(s), as well as any support system required, and this detailed plan shall be approved by the Engineer prior to any installation or use of steel plate(s) by the Contractor. If deemed necessary by the County, this plan may need to be sealed by a professional engineer, licensed in the State of Maryland.

The Contractor shall place proper signs at the locations of all steel plate(s) and such signs shall conform to MUTCD specifications. Spacing of any signs shall be determined by the field conditions and shall be approved by the Engineer.

All steel plates must be flat, at least one inch (1") thick, and held in place with pins. Steel plate(s) must be large enough to allow a minimum of one foot (1') of bearing on three (3) sides of the trench or open cut excavation. Steel plate(s) are to be set as flush as possible with the road surface so there is no movement of the steel plate(s) when traversed by vehicles.

Bituminous concrete cold mix must be used on all edges of the steel plate(s) to minimize the hazard to the motoring public. Cold mix must be tapered from the height of the steel plate(s) to the existing road surface to provide a smooth transition for traveling vehicles.

If the steel plate(s) are to be left in any roadway longer than seven (7) calendar days, the steel plate(s) must be recessed as to be flush with the riding surface.

The Contractor must provide the Engineer with at least two (2) contact persons and corresponding phone numbers to respond to any emergencies or problems with any steel plate(s) and/or support system. Should an emergency or problem occur that requires immediate action, County forces shall correct such emergency or problem, and the County shall charge the Contractor for any costs incurred by the County.

Steel plates are considered incidental to any Contract Construction and/or Work. No County payment shall be made to the Contractor for the use or installation of any steel plate(s) or support system, or for any additional permanent or temporary trench repair required by the County.

The new General Provisions (GP) and Terms and Conditions (TC) supersedes the Standard Specifications dated February 2000 and Addendums

GENERAL PROVISIONS

GP - SECTION 1
DEFINITIONS AND TERMS

GP-1.01 GENERAL

This volume is based on the Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials dated July 2008, as amended in this volume. It has been prepared as the Manual of Standard Specifications under the authority of Section 32-4-404 of the Baltimore County Code, 2003, as amended from time to time.

Baltimore County has adopted a set of Standard Detail Drawings as its Manual of Standard Details that is published separately under the authority of Section 32-4-404 of the Baltimore County Code, 2003, as amended from time to time.

GP-1.02 ORGANIZATIONAL STRUCTURE

Reference to Specifications or procedures beginning with the letters M, R, or T shall be understood to be AASHTO.

Reference to Specifications or procedures beginning with the letters B, C, D, E, F, G, ES or P shall be understood to be ASTM.

GP-1.03 LANGUAGE

It shall be understood that when all such expressions such as "directed, specified, authorized, permitted, approval, acceptable or satisfactory" are used they are implicitly followed by the words "by the Engineer" or "to the Engineer".

GP-1.04 ABBREVIATIONS

Wherever in these General Provisions or in other Contract Documents the following abbreviations are used, the meaning shall be as follows:

AAN	American Association of Nurserymen
AAPA	American Association of Port Authorities
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AIA	American Institute of Architects

AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ARA	American Railway Association
AREA	American Railway Engineering Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers
ASLA	American Society of Landscape Architects
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Transit Association
AWWA	American Water Works Association
AWS	American Welding Society
AWPA	American Wood Preservers Association
AWG	American Wire Gauge
AGC	Associated General Contractors of America
bccmp	bituminous-coated corrugated metal pipe
bccmpa	bituminous-coated corrugated metal pipe arch
B&S	Brown & Sharpe Wire Gauge
BOCA	Building Officials Code Administrators International
cip	cast iron pipe
cipx	cast iron soil pipe, extra strength
cmp	corrugated metal pipe
CPVC	Chlorinated Poly Vinyl Chloride
CSPA	Clay Sewer Pipe Association
COMAR	Code of Maryland Regulations
CRSI	Concrete Reinforcing Steel Institute
dip	ductile iron pipe
DIPRA	Ductile Iron Pipe Research Association
EEI	Edison Electric Institute
EIA	Electronic Industries Association
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration, U.S. Department of Transportation
FCC	Federal Communications Commission
FHWA	Federal Highway Administration, U.S. Department of Transportation
FRA	Federal Railway Administration, U.S. Department of Transportation
FSS	Federal Specifications and Standards, General Services Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineers Society
IMSA	International Municipal Signal Association
IPCEA	Insulated Power Cable Engineers Association
IRT	Institute for Rapid Transit
MBE	Minority Business Enterprise
MBMA	Metal Building Manufacturers Association

MDOT	Maryland Department of Transportation
MSMT	Maryland Standard Method of Tests (as developed by the State Highway Administration)
MUTCD	Manual on Uniform Traffic Control Devices
MdMUTCD	Maryland Manual on Uniform Traffic Control Devices
MdSHA	Maryland State Highway Administration
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NCHRP	National Cooperative Highway Research Program
NEC	National Electric Code
NESC	National Electric Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
pccp	prestressed concrete cylinder pipe
PCI	Precast Concrete Institute
PVC	Poly Vinyl Chloride
QPL	Qualified Products List
rccp	reinforced concrete culvert pipe
rcsp	reinforced concrete sewer pipe
RLMI	Reflector and Lamp Manufacturers' Institute
RMA	Rubber Manufacturers Association
SAE	Society of Automotive Engineers
SAWP	Society of American Wood Preservers
SHA	State Highway Administration
SSPC	Steel Structures Painting Council
ucpx	unglazed clay pipe, extra strength
UL or ULI	Underwriters Laboratories, Incorporated
UMTA	Urban Mass Transportation Administration, U.S. Department of Transportation
USSG	United States Standard Gauge
USSWG	United States Steel Wire Gauge
WBE	Women's Business Enterprise

GP-1.05 DEFINITIONS

Wherever in these General Provisions or in other Contract Documents the following terms are used, the meaning shall be as follows:

Additional Work - Work not required or provided for in the original Contract.

Administration - Baltimore County, Maryland, a body corporate and politic.

Administrator - The Director of the Department.

Advertisement - The public announcement, as required by law, inviting any and all prequalified contractors to submit a Bid for Work to be performed or provided.

Agreement - The written agreement executed between the County and the successful Bidder covering the performance of the Work by which the Contractor is bound to perform the Work and by which the County is obligated to compensate the Contractor therefor at a mutually established and accepted rate or price. The Agreement shall include all the documents listed under "Contract Documents", as well as any written Contract Modification that is required to complete the Construction and completion of the Work in an acceptable manner, including any authorized extension thereof, all of which constitute one instrument and agreement. The Agreement shall be executed by the Contractor and the County as indicated by the signature of the Contractor's duly and legally authorized representative and the County Executive or his/her legally authorized designee, with evidence thereof of review for legal sufficiency by the County's Office of Law.

Alley - An established passageway for vehicles and pedestrians affording a secondary means of access in the rear to properties abutting on a street or Highway.

Approved Source of Supply - Listing prepared by the Department on a periodic basis and available on the Department's website.

Architect and/or Design Engineer - The Maryland licensed and registered architect and/or design engineer under separate contract with the County to prepare the Plans and Contract Documents.

As-Built Drawings - A complete set of sealed and signed as-built Mylar record Contract Drawings that are based on the marked-up prints or red-lined drawings received from the applicable contractor, the shop drawings, any addenda, any change orders, any requests for information, and any other data utilized by the Contractor so as to provide a complete and accurate as-built record.

Award - The decision and notice given by the County of the acceptance of a Bid or Proposal. The successful Bidder understands and expects the County to substantially, materially and justifiably rely upon its Bid from the date of Award pending execution of the Agreement.

Baltimore County - Baltimore County, Maryland, a body corporate and politic.

Base Course - The one or more layers of specified material and thickness placed on a Subbase or a Subgrade to support a Surface Course.

Bid - A written submission including, but not limited to, price, terms of sale, and description of work technical expertise, work experience, and any other information requested in the Bid Package, offered by a Bidder to the County in response to the County's Bid Package or request for Proposal.

Bid Bond - The security required and described in the Bid Package and GP-2.07 to be included in the Proposal and furnished by the Bidder as a guaranty of good faith to enter into a Contract with the County if the Work is Awarded to the Bidder.

Bid Form - The approved form included in the Bid Package and/or Proposal Form, on which the Administration requires the Bid to be set forth and submitted.

Bid Item - An item of Work specifically described and for which a price, either unit or lump sum, is required. It includes the performance of all Work described herein or described in any Supplemental Specifications or Special Provisions.

Bid Package – Includes, but is not limited to, the Standard Specifications and any Contract Document included and/or incorporated by reference therein, used by the County for soliciting and procuring Bids by competitive sealed Bid and/or requests for Proposals and/or small procurement procedures including, but not limited to, requests for quotations, requests for Bids, etc.

Bidder - A Person formally submitting a Bid for the Work, acting directly or through a duly and legally authorized representative.

Bridge - A structure including supports erected over a depression or an obstruction, such as water, Highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the Road of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening. For lengths, all dimensions shall be parallel to the center line of the Road. The dimensions of handrails will not be taken into account in measuring bridge lengths. Any Bridge or Highway grade separation structure includes the connecting Highways, Substructure, Superstructure, Road approaches, entrance plazas, interchanges, overpasses, underpasses, and other Structures which the Administration may deem necessary together with all property rights, Easements, franchises, and interests acquired by the Administration for the Construction and operation of the Bridge.

Business - A corporation, partnership, individual, sole proprietorship, joint venture, or any other legal entity through which commercial activity is conducted.

Business Day - Every day shown on the calendar except Saturdays, Sundays and Holidays.

Calendar Date – The specific calendar date by which Contractor must achieve Full and Final Completion of the Work and all requirements under the Contract.

Calendar Day - Every day shown on the calendar, Saturdays, Sundays and Holidays included.

Certification - A document which states that the Material and/or Work complies with the applicable specifications and includes the actual test results to confirm the statement. The contents of the Certification shall be on the contractor's/vendor's/manufacturer's letterhead or

approved document and shall be duly signed by a legally and duly authorized officer. Certifications for metal products, when required, shall include a statement that the metal product was melted and manufactured in the United States.

Change Order - A written order amending the Contract and signed by the responsible Engineer, authorizing and requiring changes to the original Contract, with or without the consent of the Contractor. Each Change Order shall be executed by the Contractor and the County as indicated by the signature of the Contractor's duly and legally authorized representative and the County Executive or his/her legally authorized designee, with evidence thereof of review for legal sufficiency by the County's Office of Law.

Completion Date - The number of Working Days, Calendar Days, or Calendar Date shown in the Contract indicating the time allowed for the Full and Final Completion of the Work contemplated in the Contract.

Construction – To build, alter, Repair, improve and/or demolish any structure, building, or other improvement to real property and/or fixtures.

Construction Strip - An area contiguous to a permanent fee area or Easement, temporarily acquired for the use of the Contractor during the execution of the Work. This area exists only when shown on the Plans.

Contingent Item - Any Bid Item listed in the Contract Documents and included in the Bid for the purpose of obtaining a Contract price. Such Bid Item(s) constitutes tender of an exercisable option to and for the benefit of the County to incorporate such Bid Item(s) into the Work in accordance with the stated Bid prices.

Contract - The written agreement executed between the County and the successful Bidder covering the performance of the Work by which the Contractor is bound to perform the Work and by which the County is obligated to compensate the Contractor therefor at a mutually established and accepted rate or price. The Contract shall include all the documents listed under "Contract Documents", as well as any written Contract Modification that is required to complete the Construction and completion of the Work in an acceptable manner, including any authorized extension thereof, all of which constitute one instrument and agreement. The Contract shall be executed by the Contractor and the County as indicated by the signature of the Contractor's duly and legally authorized representative and the County Executive or his/her legally authorized designee, with evidence thereof of review for legal sufficiency by the County's Office of Law.

Contract Bond – Means Bid Bond, Payment Bond, Performance Bond and/or Proposal Guaranty, as applicable.

Contract Documents - The Contract executed between the Administration and the successful Bidder, covering the performance of the Work by which the Contractor is bound to perform the Work, and by which the Administration is obligated to compensate Contractor therefor at the mutually established and accepted rate or price. The Contract Documents shall include, but not be limited to, the Bid Package (which includes, but is not limited to, the instructions to bidders

document, the information for bidders document and the specifications), Extra Work Order, Proposal Form, Proposal, Contract Bond, General Provisions, Contract Drawings, Special Provisions, Technical Provisions, all Plans and Notices to Proceed, also any Change Order, Contract Modification and Supplemental Agreement that are required to complete the Work in an acceptable manner, including County-authorized extensions of time for completion thereof, the Award, and the Agreement.

Contract Drawings - The official drawings issued by the Administration as part of the Contract Documents, including those incorporated in the Contract Documents by reference.

Contract Item or Pay Item - An item of Work specifically described and for which a price, either unit or lump sum, was provided in the form of a County-approved Bid Item and incorporated into the Contract, unless expressly stated to the contrary by the County. It includes the performance of all Work described therein.

Contract Modification - Any written change to the Contract including, but not limited to, delivery point, date of delivery, Contract period, price, quantity, or other provision of any original and/or existing Contract, whether accomplished in accordance with a Contract provision, or by mutual written action of legally and duly authorized representatives of the parties to the Contract including, but not limited to, any Change Order, Extra Work Order, Supplemental Agreement, and/or other form of Contract Modification. Each Contract Modification shall be executed by the Contractor and the County as indicated by the signature of the Contractor's duly and legally authorized representative and the County Executive or his/her legally authorized designee, with evidence thereof of review for legal sufficiency by the County's Office of Law.

Contract Number - The eight-place combination of numerals and letters by which all Contracts are identified:

9 6 0 0 0 X X 0

The first two digits indicate the year. The next three digits indicate the sequential numbering; the first Contract of each year is numbered 001, the second Contract 002 etc., regardless of the division of the Contract.

The three-space alpha-numeric combination (X X 0 above) indicates the general nature of the Work and the division of the Contract for accounting purposes. The two letters (X X) indicate the general nature of the Work. The last digit indicates the numerical division of the Contract. A zero as the last digit indicates that the Contract will be accounted as a whole.

GENERAL NATURE OF THE WORK

First X	**Second X**
B - Bridge	D - Development (Public)
C - Culvert	F - Fire Station
D - Storm Drain	L - Library
G - Grading or miscellaneous	

P - Public Building
R - Road
(except when used with RA, indicates Right-of-Way Improvement)
S - Sewer
W - Water
U – Utility
O - Operating Building
P - Police Station
X - Capital Improvement
S - Development (Private **other than UA or RA)**
A - Agreement **(for Private UA and RA)**

Contract Time - The number of Working Days, Calendar Days, or a Calendar Date specified in the Contract Documents indicating the time period allowed for the Full and Final Completion of the Contract Work.

Contractor - The party of the second part to the Contract; the Person undertaking the execution of the Work under the terms of the Contract and acting directly or through his, their, or its agents or employees. If the party of the second part is comprised of one or more Persons, each shall be jointly and severally responsible for the performance of the entire Contract and jointly and severally liable to the County.

Controlling Operation - An operation that at the particular time under consideration has a controlling effect on the progress of the project as a whole.

County – Baltimore County, Maryland, a body corporate and politic.

County Roads - Any public Road in the County, excluding State Roads, fee title to which, or Easement for the use of which, is vested in the County by grant of condemnation, dedication, conveyance or by operation of law.

Culvert - Any structure not classified as a Bridge that provides an opening under any Roadway.

Day - Calendar Day unless otherwise designated.

Department - The Department of Public Works of Baltimore County, unless another County department or office is expressly identified and designated by the County.

Domestic Manufacture - When referring to metallic items such as structural steel, pipe, reinforcement, bridge rails, etc., the term Domestic Manufacture means those metal products that have been melted and manufactured within the United States.

Drainage Ditch - In general, any open water course other than gutters, constructed as indicated in the Contract Documents.

Easement - A grant of a) an interest in property and b) a right of use of property of an owner for a certain purpose at the will of the grantee.

Engineer – Unless an official is expressly identified in writing by the County or expressly stated in the Contract Documents, Engineer means any one of the following:

Director of the Department, or his authorized delegated representative,
Deputy Director of the Department (if applicable),
Chief, Division of Construction Contracts Administration of the Department, or
Chief, Bureau of Engineering & Construction of the Department.

Any delegation of the Engineer's authority must be authorized in writing by any one of the above listed officials or expressly stated in the Contract, and such delegation of authority will pertain only to the specific Contract and/or Contracts as expressly stated in the authorization.

If the Engineer's authority is delegated as specified above to another County department or office, "Department" shall mean the County department or office delegated such authority, and any references to a director, deputy director, chief, division, or bureau shall mean the corresponding official, employee, division, bureau or office of the County department delegated such authority, as applicable and appropriate; provided that, any references to "Department" rules, lists, or published and/or adopted materials shall continue to refer to the County Department of Public Works.

Equipment - All machinery, tools, and apparatus necessary for the proper Construction and acceptable completion of the Work, together with the necessary supplies for upkeep and maintenance.

Extra Work - Work that was not required or provided for in the original Contract.

Extra Work Order - A written document amending the Contract by adding, deleting, or modifying the Contract to include price, time and/or Extra Work and/or conditions not previously addressed within the Contract. Each Extra Work Order shall be executed by the Contractor and the County as indicated by the signature of the Contractor's duly and legally authorized representative and the County Executive or his/her legally authorized designee, with evidence thereof of review for legal sufficiency by the County's Office of Law.

Federal Agencies - Reference to any federal agency or official shall be deemed made to any agency or official succeeding in conformance with law or regulations to the powers, duties, jurisdictions, and authority of the agency or official mentioned.

Final Acceptance for Maintenance - The date upon which all the Work is sufficiently complete in accordance with the Contract so that the County can occupy and utilize the Work for the purposes for which it was intended, and more specifically, the date that the Engineer makes written acceptance of all Work under the Contract for the purpose of the County assuming maintenance responsibilities for all Work, as further described in Section GP-5.13(b) of the Standard Specifications. Final Acceptance for Maintenance will also be considered Substantial Completion for purposes of the Contract and the Work.

Fixed-Price Items - Unit prices established and prescribed by the County to compensate for the cost of Work and Materials that may or may not be necessary for the proper completion of the Contract, and the quantities of which are not amenable to the reliable quantitative estimate prior to Construction. Fixed-Price Items are shown on the Proposal sheets with the estimated quantities, fixed price, and estimated total cost imprinted prior to issuance of the Contract Documents to Bidders.

Full and Final Completion - The date upon which the County acknowledges in writing that the Contractor fully and finally completed all aspects of the Contract and the Contract Work, and met all terms, conditions and obligations of the Contract, as further described in Section GP-8.11 of the Standard Specifications.

General Provisions or GP - Contract provisions published as part of, or provided as a supplement to these Standard Specifications intended for general application and repetitive use.

Highway or Road - Includes rights-of-way, surfaces, Subgrades, Shoulders, Median dividers, drainage facilities and Structures, Road cuts, Road fills, traffic barriers, Bridges, Highway grade elimination Structures, tunnels, overpasses, underpasses, interchanges, entrance plazas, approaches and other Structures forming an integral part of a street, Road, or Highway; including bicycle and walking paths and related storm water management facilities and Structures. In addition, the terms include any other property acquired for the Construction, operation, or use of the Highway.

Highways Standards - Official MdSHA "Book of Standards, Highways and Incidental Structures" edited by the MdSHA with the latest incorporated revisions issued on or before the date of Advertisement of the Contract. These Highway Standards are used where County projects are constructed within MdSHA rights-of-way, or as directed by these Specifications or by the Engineer.

Holidays – Holidays only occur on:

January 1	New Year's Day
3rd Monday in January	Martin Luther King's Birthday
3rd Monday in February	President's Day
4th Monday in May	Memorial Day
July 4	Independence Day
1st Monday in September	Labor Day
2nd Monday in October	Columbus Day
November 11	Veteran's Day
4th Thursday in November	Thanksgiving Day
December 25	Christmas Day

All days of general and congressional elections (not primary elections) throughout the State.

If a Holiday falls on a Sunday, the following Monday shall be deemed and treated as a Holiday.

If a Holiday falls on a Saturday, the Friday immediately preceding shall be deemed and treated as a Holiday.

Informal Contract - A Private Contract not exceeding twenty-five thousand dollars ($25,000), subject to the approval of the County's Department of Permits, Approvals and Inspections, bid on a lump sum basis, and not requiring a Contractor Performance Bond or Payment Bond. Informal Contracts may be used for commercial water meters and detector checks two (2) inches and smaller, fire hydrants, sanitary connections, residential water and sewer house connections for four (4) lots or less, and small road and drain projects not exceeding the twenty-five thousand dollars ($25,000).

Inspector - The authorized representative of the Engineer assigned to make detailed inspection of any or all portions of the Work.

Interim Supplemental Specifications or ISS – Those items required by the Department and the County for all County contracts, which shall be included as part of the Contract Documents and incorporated into the Contract, but which are not formally published in the Standard Specifications. The ISS control over the Standard Specifications but do not control over the Special Provisions.

Laboratory - The testing Laboratory of the State Highway Administration (or other administrations) or any other testing Laboratory designated by the Engineer.

Landscaping (Highway) or Roadside Development - Work for the preservation of natural and landscaped areas and the rehabilitation and protection against erosion of all areas disturbed by Construction through turf establishment and the placing of other ground covers, suitable planting, and other improvements to increase the effectiveness and enhance the appearance of the Highway.

Major Contract Items - The original Contract Items of greatest cost, excluding Contingent Items, (computed from the original price and estimated quantity or lump sum price) plus such other Contract Items next in sequence of lower cost (computed in like manner) as are necessary to show a total cost of original prices and quantities of not less than sixty percent (60%) of the original total cost of the Work, Bid and/or Proposal.

Median - The portion of a divided Highway separating the Traveled Ways for traffic in opposite directions.

Materials - Any substances and/or goods specified for use in the Construction of the Work and its appurtenances.

Minor Contract Items - All Contract Items other than the Major Contract Items and Contingent Items.

Minor Structure - Any structure not classified as a building, Bridge or Culvert. Minor Structures include, but are not limited to, catch basins, fences, inlets, manholes, retaining walls, steps and other miscellaneous items.

Notice to Proceed - A Written Notice to the Contractor of the date on or before which Contractor shall begin the prosecution of the Work to be done under the Contract.

Partial Acceptance for Maintenance - The date upon which the Engineer makes written acceptance of a unit or portion of the Work under the Contract and the County assumes maintenance responsibilities for only that unit or portion of Contract Work, as further described in Section GP-5.13(a) of the Standard Specifications.

Pavement Structure - The surface, base, or Subbase Course placed in layers on a Subgrade to support and distribute the traffic load to the Roadbed.

Pay Item - An item of Work specifically described and for which a price, either unit or lump sum, was provided in the form of a County-approved Bid Item. It includes the performance of all Work described therein..

Payment Bond - A County-approved form of security furnished and executed by the Contractor and Contractor's Surety as a guaranty of good faith to pay promptly, or cause to be paid promptly, in full, such sums as may be due for Material and/or labor supplied or performed, and/or services rendered by third parties in the prosecution of the Work under the Contract. This Payment Bond is in addition to the Performance Bond.

Performance Bond - The County-approved form of security, furnished and executed by the Contractor and Contractor's Surety, guaranteeing Full and Final Completion of the Work in complete compliance with and in accordance with the Contract and all Contract Documents. This Performance Bond is in addition to the Payment Bond.

Person - A corporation, partnership, individual, sole proprietorship, joint venture, or any other legal entity through which commercial activity is conducted.

Plans - The official drawings issued by the Administration as part of the Contract Documents, including, but not limited to, those incorporated in the Contract Documents by reference.

Private Contract - A private contract for Highway, storm drain, water main, utilities, roads, and sanitary sewer Construction let by applicants or Persons, by procedures pursuant to Public Works Agreements with County at no cost to County. The developer, in such a Private Contract, obtains the bid privately using contract forms provided by the Department's Division of Construction Contracts Administration. Private Contracts bearing the letters "UA" or "RA" within their Contract Numbers are governed and initiated by the Baltimore County Department of Permits, Approvals and Inspections Policy for the Construction of Improvements Under Private Contracts, pursuant to Baltimore County Code Section 32-4-301, as amended, and shall be referred to as UA and/or RA, as applicable, in these Standard Specifications.

Procurement Agency - Baltimore County, Maryland, a body corporate and politic.

Profile Grade - The trace of a vertical plane intersecting the top surface of the proposed wearing surface usually along the longitudinal center line of the Road. Profile Grade means either elevation or gradient of the vertical plane.

Proposal – A written submission including, but not limited to, price, terms of sale, and description of work technical expertise, work experience, and any other information requested in the Bid Package, offered by a Bidder to the County in response to the County's Bid Package or request for Proposal.

Proposal Affidavit – An affidavit form (included in the Invitation for Bid) to be a certified form executed by a legally authorized representative of the Bidder and required to accompany a Bid.

Proposal Form - Includes, but is not limited to, the Standard Specifications and any Contract Document included and/or incorporated by reference therein, used by the County for soliciting and procuring Bids by competitive sealed Bid and/or requests for Proposals and/or small procurement procedures including, but not limited to, requests for quotations, requests for Bids, etc.

Proposal Guaranty - The security required and described in the Bid Package and GP- 2.07 to be included in the Proposal and furnished by the Bidder as a guaranty of good faith to enter into a Contract with the County if the Work is Awarded to said Bidder.

Questionnaire - The approved form or forms upon which the Contractor shall furnish the information as to its ability to perform the Work, its experience in similar Work, the Equipment to be used, and its financial condition as related to its ability to finance the Work.

RA - A private contract for Highway, storm drain, water main, and sanitary sewer Construction is let by land developers, by procedures pursuant to Public Works Agreements with Baltimore County, Maryland. The developer, in such a Contract, obtains the Bid privately using Contract forms provided by the Division of Construction Contracts Administration. Private Contracts bearing the letters "RA" within their Contract Numbers are governed by the Baltimore County Department of Permits, Approvals and Inspections Policy for the Construction of Improvements Under Private Contracts pursuant to Baltimore County Code Section 32-4-301, as amended, and shall be referred to as RA and/or UA Contracts or RA and/or UA in these Standard Specifications.

Ramp - A connecting Road between two intersecting Highways at a Highway separation.

Regional Engineer - Unless an official is expressly identified in writing by the County or expressly stated in the Contract Documents, Regional Engineer means any one of the following:

Director of the Department, or his authorized delegated representative,
Deputy Director of the Department (if applicable),
Chief, Division of Construction Contracts Administration of the Department, or

Chief, Bureau of Engineering & Construction of the Department.

Any delegation of the Regional Engineer's authority must be authorized in writing by any one of the above listed officials or expressly stated in the Contract, and such delegation of authority will pertain only to the specific Contract and/or Contracts as expressly stated in the authorization.

If the Regional Engineer's authority is delegated as specified above to another County department or office, "Department" shall mean the County department or office delegated such authority, and any references to a director, deputy director, chief, division, or bureau shall mean the corresponding official, employee, division, bureau or office of the County department delegated such authority, as applicable and appropriate; provided that, any references to "Department" rules, lists, or published and/or adopted materials shall continue to refer to the County Department of Public Works.

Repair - To restore after injury, deterioration, or wear; to mend, to renovate, by such means as appropriate, and to supply such Materials and labor as necessary to render the item to be repaired sound, solid, true, plumb, square, even, smooth, and fully serviceable. Upon completion of such repair it must be, unless otherwise stated, rendered to such condition as to present a first-class finished work, or in instances where the repaired item serves as a base for additional finish, the repaired work must be such as to permit a first-class finish, to be applied without extra cost to the County. When the word "Repair" is used in connection with machinery or mechanical Equipment, it shall mean, in addition to the above, rendering the Equipment completely serviceable and efficient, ready for the normal use for which it was originally intended.

Responsible Bidder - A Person who is a Prequalified Contractor, as further described in these Standard Specifications and pursuant to the County's Rules for Prequalification of Contractors, as described in GP-2.00 of these Standard Specifications, and who has the capability in all respects to perform fully the Contract requirements and to perform all mandatory and essential requirements of the Bid, and the integrity and reliability that shall assure good faith performance.

Responsive Bid - A Bid submitted in response to a Bid Package that conforms in all material respects to all requirements contained in the Bid Package, including, but not limited to, all mandatory and essential requirements of the Bid.

Responsive Bidder - A Responsible Bidder whose Bid conforms in all material respects to the Bid Package, including, but not limited to, all mandatory and essential requirements of the Bid.

Right-of-Way - The area that has been acquired and reserved by the County for use in constructing the proposed improvement and appurtenances thereto. The area may be held by the County for use in constructing the proposed improvements and appurtenances thereto. The area may be held by the County in fee simple or as an Easement -- perpetual or temporary, recorded or unrecorded.

Roadbed - The graded portion of a Highway within the top and side Slopes prepared as a foundation and/or the top surface of a Road upon which the Pavement Structure, Shoulders, and curbs are constructed.

Road, Roadway or Highway - The words Road, Roadway and Highway include rights-of-way, surfaces, Subgrades, Shoulders, Median dividers, drainage facilities and Structures, Roadway cuts, Roadway fills, traffic barriers, Bridges, Highway grade elimination Structures, tunnels, overpasses, underpasses, interchanges, entrance plazas, approaches, and other Structures forming an integral part of a street, Road, Roadway, or Highway; including bicycle and walking paths and related storm water management facilities and Structures. Any other property acquired for the Construction, operation, or use of the Highway.

Roadside - A general term denoting the area adjoining the outer edge of the Roadbed within the Right-of-Way. Extensive areas between the Road of a divided Highway may also be considered Roadside.

Roadside Development - Work for the preservation of natural and landscaped areas and the rehabilitation and protection against erosion of all areas disturbed by Construction through turf establishment and the placing of other ground covers, suitable planting, and other improvements to increase the effectiveness and enhance the appearance of the Highway.

Seal Coat - An application of asphalt material followed by an application of cover coat aggregate.

Shoulder - The portion of the Roadbed contiguous with the Traveled Way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and Surface Courses.

Sidewalk - The portion of the Road constructed for use by pedestrians.

Slopes - The inclined graded areas beyond the Shoulder, extending from the Shoulders to the natural, undisturbed surface of the ground.

Special Provisions or SP - Specifications for a specific item or condition or requirement peculiar to the Work and not otherwise thoroughly or satisfactorily detailed elsewhere in the Contract Documents. If a Special Provision or SP is in conflict with any portion of the Contract Documents, the Special Provisions shall always control and prevail. Specifically, the Special Provisions control over the Standard Specifications and the Interim Supplemental Specifications.

Standard Details / Standard Detail Drawings / Baltimore County Standard Details for Construction - The Baltimore County, Maryland Department of Public Works Standard Details for Construction published by the Administration for general application and repetitive usage, as may be supplemented, revised and superseded by the Contract Documents, which include detail drawings showing standard methods of Construction for water mains, sanitary sewers, storm drains, roads and streets.

Standard Specifications - The Baltimore County Department of Public Works Standard Specifications for Construction and Materials published by the Administration for general application and repetitive use, as may be supplemented, revised and superseded by the Contract Documents.

State - The State of Maryland.

State Agency - A State agency or official thereof, including any agency or official succeeding to their powers, duties, jurisdictions and authority in accordance with law.

State Highway System - The system of Roads owned, operated, or maintained by the State of Maryland.

State Road - Any public Road included in the Maryland State Highway System.

Structure(s) - Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, end walls, buildings, sewers, service pipes, underdrains, foundation drains, steps, fences, and other features that may be encountered in the Work and not otherwise classified.

Subbase - The layers of specified or selected material of designed thickness placed on a Subgrade to support a Base Course or Surface Course.

Subcontract - Any agreement entered into by the Contractor with a Subcontractor for a portion of the Construction or any other part of the Work in connection with, and under the terms of, the Contract.

Subcontractor - Any Person undertaking a portion of the Construction or any other part of the Work under the terms of the Contract, by virtue of an agreement with the Contractor. Subcontractor does not include an employee with an employment contract, or an employee organization with a collective bargaining agreement. It includes one who furnished Material worked to a special design according to the Plans and Specifications for the Work. It excludes one who merely furnished Material not so worked.

Subgrade (Highways) - The top surface of a Roadbed upon which the Pavement Structure, Shoulders, and curbs are constructed.

Subgrade (Pipes) - The soil foundation layer upon which a pipe, cradle, or encasement is placed such that the prescribed invert elevation of the pipe will be achieved.

Subgrade (Structures) - The soil foundation layer upon which the structural foundation is built to achieve prescribed elevations of subsequent structural elements or controls.

Substantial Completion / substantial completion - The date upon which all the Work is sufficiently complete in accordance with the Contract so that the County can occupy and utilize the Work for the purposes for which it was intended, and more specifically, the date that the Engineer makes written acceptance of all Work under the Contract for the purpose of the County assuming maintenance responsibilities for all Work, as further described in Section GP-5.13(b) of the Standard Specifications. Substantial Completion will also be considered Final Acceptance for Maintenance for purposes of the Contract and the Work.

Substructure - All of that part of the Structure below bottoms of bearings of simple and continuous spans, skewbacks of arches and tops of footings of rigid frames, together with the back walls and wing walls.

Superintendent - The executive representative of the Contractor duly authorized by the Contractor, in accordance with Contractor's organizational documents and requirements to receive and execute instructions from the Engineer, and who shall supervise and direct the Construction and the Work.

Superstructure - All of that part of the Structure above bottoms of bearings of simple and continuous spans, skewbacks of arches and tops of footings of rigid frames, except as noted above for Substructure.

Supplemental Agreement - Any written Contract Modification or Change Order evidencing, among other things, the terms, conditions, costs and time, mutually agreeable to the Contractor and the County as indicated by the signature of the Contractor's duly and legally authorized representative and the County Executive or his/her legally authorized designee, with evidence of review for legal sufficiency by the County's Office of Law.

Surety - The Person providing any or all of the Contract Bonds for the Contractor, for the Bid and the Full and Final Completion of the Contract and/or for the payment for all of the Work in connection with the Contract.

Surface Course - One or more layers of a pavement designed to accommodate direct traffic loading.

Technical Provisions - The technical provisions included in the Proposal Form and/or Invitation for Bid, which are a part of and incorporated into the Contract.

Third Tier Contracting - The process where the Contractor subcontracts a portion of the Contract to a Subcontractor who in turn subcontracts a portion of the Contract to a third party. This latter action is termed entering into a Third Tier Contract.

Traveled Way - The portion of the Roadway for the movement of vehicles, exclusive of Shoulders.

Trench - An excavation made for the purpose of installing or removing pipes, drains, catch basins, etc., which is later refilled.

UA - A private contract for Highway, storm drain, water main, and sanitary sewer Construction is let by land developers, by procedures pursuant to Public Works Agreements with Baltimore County. The developer, in such a Private Contract, obtains the bid privately using contract forms provided by the Department's Division of Construction Contracts Administration. Private Contracts bearing the letters "UA" within their Contract Numbers are governed by the Baltimore County Department of Permits, Approvals and Inspections Policy for the Construction of

Improvements Under Private Contracts, pursuant to Baltimore County Code Section 32-4-301, as amended, and shall be referred to as UA and/or RA Contracts or UA and/or RA in these Standard Specifications.

Unclassified Excavation - Excavation not defined within Standard Specifications' classifications, including, but not limited to, rock, logs, stumps, water, debris. (Excavation of all utility Trenches to subgrade.)

Utility Agreements/Right-of-Way Agreements or UA/RA- These UA/RA are initiated in the County Department of Permits, Approvals and Inspections (PAI), or any successor County department, by the applicant, including, but not limited to developers, schools, or commercial property owners for the Construction and installation of improvements to utilities or roads at no cost to the County. PAI reviews and approves, if and as applicable, the cost estimates, Construction drawings, UA and/or RA, as applicable, and collects any security and fees.

Utility Companies – Entities or Persons which may have utility facilities in a proposed Work area (e.g. BG&E and Verizon, etc.)

Work – The Contractor's furnishing of all labor, Materials, Equipment, services, supplies, Construction, construction-related services and/or other incidentals necessary to successfully perform and complete the Contract and carry out of all the duties and obligations imposed by the Contract.

Working Day - A Calendar Day upon which, in the judgment of the Engineer, weather and soil conditions are such that the Contractor can advantageously Work more than half of his current normal force for more than five (5) consecutive hours on a Controlling Operation. Working Days will not be charged on Saturdays, Sundays, and Holidays unless the Contractor actually Works more than five (5) hours on a Controlling Operation.

Working Drawings - Stress sheets, shop drawings, fabrication details, erection Plans, Plans for false work, forms, centering, cribs, cofferdams and masonry layouts, bending and placing drawings, bar schedules for reinforcement steel, and any other supplementary Plans or similar data that the Contractor may be required to furnish.

Written Notice - Shall be deemed to have been duly served if delivered with signed receipt or if sent by certified registered mail with signed receipt to the last business address known to party who gives the notice.

GP - SECTION 2
BIDDING REQUIREMENTS AND CONDITIONS

GP-2.00 GENERAL

All terms that are capitalized in this GP - Section 2 shall be in accordance with the Department Rules for Prequalification of Contractors, adopted November 28, 2006. Only the Bid of a

Contractor who holds a valid Certificate ten (10) Days prior to the date of Bid Opening will be considered. A Prequalified Contractor is one whose rating and classification have been determined by the Prequalification Committee and ratified by the Director of the Department.

All applicants for prequalification must comply with all Procedures for Prequalification as described in Article II of the Rules for Prequalification of Contractors.

All information must be filed with the Department in sufficient time for action to be completed ten (10) Days before the date of Bid opening.

A prospective Bidder, when prequalifying, shall state in the Application the extent and type of work it considers it is qualified to handle at one time and shall show the exact type of work it has performed during the preceding five (5) years. The information and all other information required by Procedures for Prequalification, as described in Article II of the Rules for Prequalification of Contractors, shall be the basis for a determination of the Bidder's financial rating and work classifications. Following the evaluation, the Contractor may receive a Certificate of Prequalification from the Director of the Department of Public Works.

A Prequalification Certificate, subject to the following provision, is valid through the expiration date stated on the Certificate. The County reserves the right to re-evaluate a Prequalified Contractor. A Bidder who holds a Prequalification Certificate shall furnish additional information bearing on its qualification as may be required. The County reserves the right to reject unopened the Bid of any Bidder who fails to furnish promptly and properly all the information called for when so notified.

A Contractor, dissatisfied with its rating or classification or both, may request a reconsideration on the basis of additional or revised information submitted to the committee in writing and may request a meeting with the Prequalification Committee to support its resubmittal in accordance with the Rules for Prequalification.

EACH BIDDER AND/OR APPLICABLE SUBCONTRACTOR SHALL FURTHER QUALIFY AS OTHERWISE REQUIRED IN THE CONTRACT DOCUMENTS.

A prospective Bidder may purchase Plans if his Prequalification Certificate is valid. Materials suppliers and other interested parties may purchase Plans without prequalification, such Plans to be marked: "NOT FOR BIDDING PURPOSES".

GP-2.01 BID IRREVOCABLE

Unless otherwise provided in the Bid Package, Bid prices are irrevocable for ninety (90) Days following Bid opening.

GP-2.02 CONTENTS OF BID FORMS

All papers included in, bound thereto or attached to the Invitation for Bid and/or the Proposal Form are necessary parts thereof and shall not be detached, separated or altered. The Plans, Standard Specifications, and all other Contract Documents are part of the Invitation for Bid and/or the Proposal Form whether attached thereto or not.

GP-2.03 INTERPRETATION OF QUANTITIES IN BID SCHEDULE

Where designated as estimated quantities, the quantities in the prepared Invitation for Bid are approximate only. Payment to the Contractor will be made only for the actual quantities of Work performed or Materials furnished in accordance with the Contract and as provided in GP-4.04, Variations in Estimated Quantities.

GP-2.04 SITE INVESTIGATION

The Contractor acknowledges that it has investigated and satisfied itself as to the conditions affecting the Work, including but not restricted to those bearing upon transportation, disposal, handling and storage of Materials, availability of labor, water, electric power, Roads and uncertainties of weather, river stages, tides or similar physical conditions at the site, and the Contractor has further confirmed conditions of the ground, and the character of Equipment and facilities needed preliminary to and during prosecution of the Work. The Contractor further acknowledges that it has satisfied itself as to the character, quality and quantity of surface and subsurface Materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory Work done by the County, as well as from information presented by the drawings and Standard Specifications made a part of this Contract. Any failure by the Contractor to acquaint itself with the available information will not relieve Contractor from responsibility for estimating properly the difficulty or cost of successfully performing the Work. The County assumes no responsibility or liability of any kind, nature or amount for any conclusions or interpretations made by the Contractor on the basis of the information made available by the County.

Notwithstanding anything to the contrary in the Standard Specifications or the Contract Documents, including, but not limited to, GP-4.05, any and all subsurface soil/test borings, sample borings, boring logs, test pits, and/or related documents, reports or materials (collectively, the "Boring Materials") provided by the County, or its engineer, architect, or consultant, to any Bidders or the Contractor are for the convenience of the Bidders and/or the Contractor. THE COUNTY NEITHER EXPRESSLY NOR IMPLIEDLY WARRANTS OR GUARANTEES THAT THE ACTUAL SITE CONDITIONS ENCOUNTERED UNDER THIS CONTRACT WILL BE THE SAME OR SIMILAR TO THOSE SITE CONDITIONS INDICATED BY ANY BORING MATERIALS.

THE CONTRACTOR HAS THE EXPRESS DUTY AND RESPONSIBILITY TO EXAMINE AND SATISFY ITSELF AS TO THE PHYSICAL CONDITIONS OF THE CONTRACT SITE, including, but not limited to, conformation and condition of the ground, character, quantity, and quality of subsurface materials which may be encountered, surface and subsurface conditions

including the presence of rock or groundwater, and all other physical conditions of the Contract site which may affect the Contractor's performance and/or costs and expenses under the Contract. THE CONTRACTOR SHALL NOT RELY ON THE COUNTY AND/OR ANY BORING MATERIALS TO FULFILL THIS EXPRESS DUTY AND RESPONSIBILITY UNDER THE CONTRACT.

NO ADDITIONAL COMPENSATION OF ANY KIND, INCLUDING, BUT NOT LIMITED TO, ADJUSTMENT OF COST OR SCHEDULING, WILL BE CONSIDERED BY THE COUNTY FOR THE CONTRACTOR'S FAILURE TO PROPERLY EXAMINE AND SATISFY ITSELF AS TO THE PHYSICAL CONDITIONS OF THE CONTRACT SITE. NOR WILL SUCH FAILURE BY THE CONTRACTOR RELIEVE THE CONTRACTOR OF ITS OBLIGATIONS, RESPONSIBILITIES, AND LIABILITIES TO ACHIEVE FULL AND FINAL COMPLETION OF THE CONTRACT TO THE COUNTY'S SATISFACTION.

GP-2.05 TAXES - RESPONSIBILITY FOR PAYMENT, EXEMPTIONS, FORMS TO FILE, ETC.

(a) The Contractor is responsible for, and by submitting a Bid agrees to pay, all retail sales, income, real estate, sales and use, transportation and special taxes applicable to and assessable against any Materials, Equipment, processes and operations incident to or involved in the Construction and/or Work. The Contractor is responsible for ascertaining and acquainting itself with such taxes and making all necessary arrangements to pay same.

(b) The County's Director, Office of Budget and Finance, may not authorize payment to a Contractor who has submitted an invoice if that Contractor is indebted by virtue of unpaid taxes or other obligations when in an amount of fifty dollars ($50) or more to the State of Maryland or any County department or agency or affiliated entity. In this regard, Contractors shall indicate their federal tax identification or social security number as required by the Rules for Prequalification of Contractors.

(c) If taxes or other obligations are owed to the State of Maryland or any County department or agency or affiliated entity, payment shall be deferred, and the Contractor shall be promptly notified. Subsequent release of the deferred payment shall be made promptly when the taxes or other obligations are satisfactorily resolved with no late fee and/or interest of any kind thereon.

(d) The County hereby reserves the right to withhold final payments under this Contract until the Contractor and/or any Subcontractors and/or Third Tier Contracting parties performing any duties under this Contract have paid all taxes or other obligations due the State or the County or any County affiliated entity.

GP-2.06 PREPARATION OF BID

(a) The Bidder shall submit the Bid upon the blank forms furnished by the Administration. The Bidder shall specify a price in U.S. dollars and cents for each Bid Item given, and shall show

the products of the respective unit prices and quantities written in figures in the column provided for that purpose, together with the total amount of the Bid obtained by adding the amounts of the several items.

(b) The Bid Form(s), including the fully and properly executed MBE/WBE forms, shall be filled out legibly in ink or typed. The Bid shall be signed by the Contractor's duly and legally authorized representative or officer, if and as applicable, of the Bidder, and attested by the Contractor's appropriate officer, if and as applicable. There must be on file with the County a copy of the current organizational documents and/or resolution, duly certified by the corporate secretary, if applicable, showing the authority, of the Person so signing on behalf of the Contractor. In lieu thereof, the Contractor may file such evidence with the Administration, duly certified by the corporate secretary, if applicable, together with a list of the names of the Contractor's officers having legal and authority to execute Contract Documents on behalf of and legally bind the Contractor, duly certified, if applicable, which listing shall remain in full force and effect, and shall be materially relied upon by the Administration, until the Director of the Department receives Written Notice to the contrary. In any case, where a Bid is signed by an attorney in fact, the same must be accompanied by a copy of the appointing document, duly certified as described above. All Bids shall be signed in ink. All erasures and/or alterations shall be initialed by the signer in ink.

(c) If the Bid Package requires the Bidder to furnish samples or descriptive literature, it shall be submitted with the Bid, unless the Bid Package provides otherwise.

(d) Bidders must specifically identify any portions of their Proposals deemed to contain confidential, proprietary information or trade secrets. Such designations will not necessarily be conclusive and Bidders may be required to justify why such material should not, upon request, be disclosed by the County under the Maryland Public Information Act, Title 10, Subtitle 6 of the State Government Article of the Annotated Code of Maryland.

(e) Bid Items for which quantities are identified in the "Summary of Quantity" sheet of the Plans, in the column headed "Contingent" or listed in the "Bid Form" are established for the purpose of obtaining Bids on one or more Bid Items that may be incorporated into the Work.

The Engineer shall have sole discretion in determining whether and to what extent such Bid Items will be incorporated into the Work. The Engineer may order incorporation of such Bid Items at any location within the Contract and at anytime during the Work. These Bid Items may not be located on the Plans. The estimated quantities set out in the Bid Package for such Bid Items are presented solely for the purpose of obtaining a representative Bid price. The actual quantities employed may be only a fraction of, or many times the estimated quantity. Neither party shall make claims for additional compensation because of any increase, decrease or elimination of such Bid Items.

The Contractor is required to pay tax, as applicable, on Materials and supplies that will be incorporated into the Work. The Contractor must pay tax, as applicable, on all Equipment that is purchased and pertains to the Work

GP-2.07 PROPOSAL GUARANTY/BID SECURITY

No Proposal will be considered unless accompanied by a guaranty of the amount specified in the Proposal in the form of either a certified check, bank cashier's check or a Bid Bond on the form provided therein or an exact facsimile thereof. The Bid Bond must be executed by a Surety that is, as of the date of the Bid: (a) licensed in the State of Maryland, (b) rated "B" or better by the A.M. Best Company, (c) on federal funded projects, authorized by the underwriting limitation contained in the U.S. Department of the Treasury Circular 570, as amended, to guaranty the amount of the Bid, and (d) in good standing as determined by the County's Engineer. The Bid Bond must guaranty payment to the County of liquidated damages as follows: (a) if only one Bid is received, the guaranteed payment shall be five (5%) percent of the Bidder's Bid amount, (b) if two or more Bids are received, the guaranteed payment shall be the difference between the Bidder's Bid amount and the next lowest Bid amount, subject to the limitation that the guaranteed payment not be greater than five (5%) percent of the Bidder's Bid amount. This Bid Bond is required in case the successful Bidder, after issuance of notice of Award, fails to comply, timely and completely, with each of the requirements set forth under Section GP-3.04.

GP-2.08 DELIVERY OF BIDS

Each Bid must be submitted in a sealed envelope plainly marked to indicate its contents. When sent by mail, the sealed Bid must be addressed to the Administration at the address and in care of the official in whose office the Bids are to be received. All Bids shall be filed prior to the time and at the place specified in the Bid Package. Bids received after the time for opening of Bids will be treated in accordance with the provisions of GP-2.12.

GP-2.09 COMMUNICATIONS AND INTERPRETATIONS - PRIOR TO BID OPENING

Any information regarding the requirements or the interpretation of any provision of the General Provisions, Special Provisions, Standard Specifications, Interim Supplemental Specifications or any part of the Bid Package, Bid and/or Bid Form shall be requested, in writing, from the Engineer; and delivered no later than five (5) Days prior to the scheduled date of Bid opening. Responses to questions or inquiries having any material effect on the Bids shall be made by written addenda, or by written notice sent to all purchasers of Contract Documents. THE CONTRACTOR SHALL NOT MAKE VERBAL INQUIRIES TO THE COUNTY, AS VERBAL INQUIRIES MAY NOT BE ACKNOWLEDGED AND SHALL NOT BE BINDING UPON THE COUNTY IN ANY MANNER OR EXTENT.

Any and all verbal interpretations and/or oral pre-Bid statements made by the Engineer, County employees or their respective representatives and/or agents shall not be binding in any manner or extent upon the County.

Pre-Bid conferences may be conducted by the Department of Public Works or the applicable County agency or department. If they are to be conducted, notice of the same will be contained

Pre-Bid conferences may be conducted by the Department of Public Works or the applicable County agency or department. If they are to be conducted, notice of the same will be contained in the Bid Package. Any minutes of Pre-Bid conferences are provided as a courtesy to the Bidders and ANY MINUTES PROVIDED ARE NOT BINDING UPON THE COUNTY IN ANY MANNER OR EXTENT.

GP-2.10 AMENDMENTS TO INVITATIONS FOR BIDS

(a) **Form.** Pre-Bid amendments shall be identified as addenda and shall require that the Bidder acknowledge receipt of all addenda issued. The addenda shall reference the portion of the proposed Invitation for Bid and/or Proposal Form it amends. Any addenda shall be issued in writing by the County.

(b) **Distribution.** Addenda shall be sent to all purchasers of Contract Documents.

(c) **Timeliness.** Addenda shall be distributed to allow Bidders a reasonable time to consider them in preparing their Bids. The Bid receipt date shall be changed in the addenda only if the distribution of the addenda, in the sole determination of the Administration, does not permit timely preparation and distribution thereof. If the Administration deems that there is adequate time for consideration of the addenda, the addenda may be silent as to the Bid receipt date.

GP-2.11 PRE-OPENING MODIFICATION OR WITHDRAWAL OF BIDS

(a) **Procedure.** Bids may be modified or withdrawn by Written Notice executed by a duly and legally authorized representative of the Bidder, received in the office designated in the Bid Package before the time and date set for Bid opening.

(b) **Disposition of Bid Security.** If a Bid is withdrawn in accordance with this GP-2.11, the Bid Bond, if any, shall be returned to the Bidder.

GP-2.12 LATE BIDS, LATE WITHDRAWALS, AND LATE MODIFICATION

(a) **Policy.** Any Bid is late if not received at the place designated in the Invitation for Bid and/or Proposal Form at or prior to the time and date set for receipt of Bids. Any request for withdrawal or request for modification received at the place designated in the Invitation for Bid and/or Proposal Form after the time and date set for receipt of Bids is late.

(b) **Treatment.** A late Bid, late request for modification, or late request for withdrawal shall not be considered. Late Bids will be returned to the Bidder unopened.

GP-2.13 OPENING AND RECORDING OF BIDS

(a) Bids, and modifications pursuant to GP-2.11, shall be opened publicly, at the time, date, and place designated in the Bid Package. The name of each Bidder, the Bid price, and such other information as is deemed appropriate by the County shall be read aloud or otherwise made available to the public. This information also shall be recorded at the time of Bid opening. The Bids shall be tabulated or a Bid abstract made. If the Bidder designates in writing trade secrets or other proprietary data to be confidential, in accordance with applicable State law, regulations, and/or these Standard Specifications including, but not limited to, GP-2.06, material so designated in writing by the Bidder shall accompany the Bid but Bidder shall make such readily separable from the Bid in order to facilitate public inspection of the nonconfidential portion of the Bid. After Contract Award, prices, makes, and model or catalog numbers of the items offered, deliveries, and terms of payment shall be available for public inspection at a reasonable time regardless of any designation to the contrary at the time of Bid opening.

(b) The Engineer shall examine the Bids to determine the validity of any requests for nondisclosure of trade secrets and other proprietary data identified in writing by the Bidder. Confidential, proprietary information, and trade secrets furnished by a Bidder may be disclosed to State and/or other County department, or agencies if there is a need for the information and may not be disclosed outside of the County except as provided by the Maryland Public Information Act or other applicable laws and/or regulations.

GP-2.14 MISTAKES IN BIDS

(a) **Mistakes Discovered Before Opening.** A Bidder may correct mistakes discovered before the time and date set for Bid opening by withdrawing or correcting the Bid as provided in GP-2.11.

(b) **Mistakes Discovered After Opening But Prior To Award.** If the Director of the Department knows or has reason to conclude that a mistake may have been made, the Bidder may be required to confirm the Bid. Situations in which confirmation may be requested include obvious, apparent errors on the face of the Bid or a Bid unreasonably lower than the other Bids submitted. If the Bidder alleges mistake, the Bid may only be corrected or withdrawn upon the written approval of the County's Director, Office of Budget and Finance, as follows:

(1) If the mistake and intended correction are clearly evident on the face of the Bid document, the Bid shall be corrected to the intended correct Bid and may not be withdrawn. Examples of mistakes that may be clearly evident on the face of the Bid document are typographical errors, errors in extending unit prices, transposition errors, and arithmetical errors.

(2) Subject to the written approval of the County's Director, Office of Budget and Finance, a Bidder may be permitted to withdraw a low Bid if:

(a) A mistake is clearly evident on the face of the Bid document but the intended correct Bid is not similarly clearly evident; or

(b) The Bidder submits proof of evidentiary value that clearly and convincingly demonstrates that a mistake was made.

(c) **Mistakes Discovered After Award.** Mistakes may not be corrected after Award of the Contract unless and only when the County's Director, Office of Budget and Finance, determines that it would be unconscionable not to allow the mistake to be corrected. Changes in price are not permitted, except as allowed in the County's sole discretion. Corrections, if permitted, shall be submitted to and approved by the County's Director, Office of Budget and Finance before being incorporated into the Contract.

GP-2.15 MINOR IRREGULARITIES

Minor irregularities in Bids, as defined below, may be waived if the County's Director, Office of Budget and Finance, determines, in his sole discretion, that it shall be in the County's best interest. The County's Director, Office of Budget and Finance, may either give a Bidder an opportunity to cure any minor irregularity in its Bid, or waive the minor irregularity where it is to the County's advantage to do so.

When at any public opening of Bids, a Bid appears to be irregular, as herein specified, this apparent fact may be announced when read. Said Bid shall be read as other Bids and then referred to the Director of the Department for consideration and appropriate action thereon in accordance with these General Provisions, laws and regulations, as applicable.

A minor irregularity is one that is merely a matter of form and not of substance, or pertains to some immaterial or inconsequential defect or variation of a Bid or Proposal from the exact requirement of the Bid Package and/or Proposal Form, the correction or waiver of which would not be prejudicial to other Bidders. The defect or variation in the Bid or Proposal is immaterial and inconsequential when its significance as to price, quantity, quality, or delivery is trivial or negligible when contrasted with the total cost or scope of the Bid Package and the labor, Materials, Equipment, services and supplies being procured, and when the intent and meaning of the entire Bid or Proposal is clear.

GP-2.16 CANCELLATION OF INVITATIONS FOR BIDS

(a) Before opening of the Bids, an Invitation for Bid may be canceled, in whole or in part, when the County determines this action is fiscally advantageous or otherwise in its best interest.

(b) When an Invitation for Bid is canceled before Bid opening, the Bids shall be returned to the Bidders submitting them and notice of cancellation shall be included and no party or Person including, but not limited to, the County shall have any liability or obligation of any amount, kind, or nature to another or any other in connection therewith.

GP-2.17 REJECTION OF INDIVIDUAL BIDS OR PROPOSALS

(a) Any Bid may be rejected, in whole or in part, when it is in the best interest of the County to do so.

(b) Reasons for rejection of a Bid may include but are not limited to:

(1) It is not a Responsive Bid.

(2) Unreasonable price.

(3) The Bidder submitting the Bid is determined to be nonresponsible. A determination of nonresponsibility may be made for, but is not limited to, any of the following reasons:

(a) Bidder debarred or ineligible and period of debarment or ineligibility not expired.

(b) The unit prices contained in a Bid are unbalanced.

(c) Evidence of collusion among Bidders.

(d) Inadequate quantity and/or quality of experience, plant, equipment, financing, manpower or other resources required to perform the Contract.

(e) Bidder's workload that, in the judgment of the Administration, might hinder or prevent the prompt completion of the subject Work if Awarded.

(f) Default by the Bidder on other contracts.

(g) Failure to pay or satisfactorily settle all reasonable and just bills due for labor and material on prior or current contracts.

(h) The same Person has an interest in more than one Bid on a Contract exclusive of being named by another Bidder as a Subcontractor.

(i) Failure to perform satisfactorily on other contracts awarded, and the conditions leading to unsatisfactory performance remain unresolved.

(j) Any other reason affecting the Bidder's ability to perform, or a record of business integrity.

(k) Bidder not otherwise qualified and eligible to receive an Award under applicable laws and regulations.

(4) The Bidder fails to supply information to the Engineer promptly, after notification from the Engineer that such information is required in connection with a determination to be made pursuant to this GP-2.17.

GP-2.18 REJECTION OF ALL BIDS, IN WHOLE OR IN PART

(a) After opening of Bids or Proposals but before Award, all Bids or Proposals may be rejected, in whole or in part, when the Engineer, with the approval of the using-County department or agency head, or his/her designee, determines such rejection is fiscally advantageous or otherwise in the County's best interest.

(b) If and as applicable, notice of rejection of all Bids shall be sent to all Bidders that submitted Bids, and Bids which have been opened shall be retained by the Department's Division of Construction Contracts Administration.

GP-2.19 BID EVALUATION AND AWARD

(a) **General.** The Contract is to be Awarded to a Responsible Bidder who is also a Responsive Bidder and whose Bid meets the requirements and evaluation criteria set forth in the Bid Package, and is either the lowest Bid price or lowest evaluated Bid price, in the County's sole discretion.

(b) **Determination of Lowest Bidder.** Bids shall be evaluated to determine which Bidder offers the lowest cost to the County in accordance with the evaluation criteria set forth in the Bid Package.

Except as otherwise provided under GP-2.14 Mistakes in Bids:

(1) The unit price will govern in the event of a discrepancy between the unit price and the extended price (product of unit price multiplied by the quantity).

(2) The sum of the extended prices will govern in the event of a discrepancy between the total lump sum and the extended prices.

(3) The written words for the lump sum will govern in the event of a discrepancy between the lump sum prices written in words and the lump sum prices written in figures.

(4) If a unit price was omitted, the unit price will be determined by dividing the extended price by the quantity.

The Administration reserves the right to make the Award by Bid Item, or groups of Bid Items, rather than total Bid if it is in the best interest of the County to do so, unless the Bidder expressly stated in its Bid that a particular or progressive Award was not acceptable to the Bidder.

(c) **Award.** Upon determination of the Responsible Bidder who is also a Responsive Bidder, and whose Bid meets the requirements and evaluation criteria of the Bid Package and is the lowest Bidder in accordance with these Standard Specifications and the Bid Package, the Contract may be Awarded to that Bidder. In accordance with these Standard Specifications and the Bid Package, a Contract may be Awarded to a Bidder offering a higher quality item than that designated in the Bid Package if that Bidder is a Responsible Bidder with the lowest Responsive Bid whose Bid meets the requirements and evaluation criteria of the Bid Package.

GP-2.20 TIE BIDS

(a) **Definition.** Tie Bids are Responsive Bids from Responsible Bidders that are identical in price, terms and conditions and which meet all the requirements and evaluation criteria set forth in the Bid Package.

(b) **Award.** If two or more Bidders shall be tied for the lowest Bid, quality and service being equal, the Contract shall be Awarded to the Bidder qualified as a minority, as defined in the State procurement regulations. If both Bidders are qualified minorities, as defined in the State procurement regulations, the Contract shall be Awarded to the minority that is a local Bidder. Please see Baltimore County Code, 2003, as amended, Article 10, Title 2, for more information and the governing statute regarding minority Bidders and local Bidders.

GP-2.21 – Reserved.

GP-2.22 MULTIPLE OR ALTERNATE BIDS

Unless multiple or alternate Bids are requested in the Bid Package, such multiple or alternate Bids may not be accepted. However, if a Bidder clearly indicates a base Bid, it shall be considered for Award as though it were the only Bid submitted by the Bidder.

GP-2.23 BID PROTESTS

(a) **Bidder Protest of Award or Alleged Improprieties.** The Bidder must file a written Bid protest of Award pursuant to this GP-2.23 of the Standard Specifications. The Bid protest of Award must be in writing and filed with the Engineer. Oral objections, whether or not acted on, are not protests.

(1) **Time for Filing.** A Bid protest of Award shall be filed not sooner than the date of Award and not later than three (3) Business Days after the date of Award. A protest based on alleged improprieties in the Bid Package which are apparent before the Bid opening or the closing date for receipt of Bids shall be filed not later than five (5) Business Days before the Bid opening date.

(2) **Content of Written Protest.** The written protest must state: the name and address of the Bidder; the Bid or Contract Number; the reasons for protest; and any supporting exhibits, evidence or documents to support the protest.

(b) **Bidder Protest of Bid Rejection.** The Bidder must file a written Bid protest of Bid rejection with the Engineer not later than three (3) Business Days from the date of the Bid rejection. Oral objections, whether or not acted on, are not protests. The written Bid protest must comply with GP-2.23(a)(2).

(c) **Department Response to Bidder Protest.** The Department's Chief of Division of Construction Contracts Administration, or other designated County official, will review the Bidder's protest, as filed pursuant to GP-2.23(a) or (b), and respond to the Bidder in writing within ten (10) Working Days of receipt of protest.

(d) **Bidder Appeal.** The Bidder may appeal the decision by the Department's Chief of Division of Construction Contracts Administration, or other designated County official, (a) to the County's Director of the Office of Budget and Finance for all MBE/WBE-related protests or (b) to the Director, or other designated County director, for all other protests.

The Bidder must file a written appeal with the relevant director not later than three (3) Business Days from the date of the Department response in GP-2.23(c). Oral objections, whether or not acted on, are not appeals. The appeal must comply with GP-2.23(a)(1) and (2), but may include any additional documentation as deemed necessary and appropriate by the Bidder.

(e) **Director Response to Bidder Appeal.** The relevant County director, as appropriate and applicable, will review the Bidder's appeal under GP-2.23(d) and respond to the Bidder in writing within fifteen (15) Working Days of receipt of appeal.

(f) **Second Bidder Appeal.** The Bidder may appeal the decision by the relevant County director, as appropriate and applicable, to the County Administrative Officer (CAO).

The Bidder must file a written appeal with the CAO not later than three (3) Business Days from the date of the director response in GP-2.23(e). Oral objections, whether or not acted on, are not appeals. The appeal must comply with GP-2.23(a)(1) and(2), but may include any additional documentation as deemed necessary and appropriate by the Bidder.

(g) CAO Response to Bidder Appeal. The CAO, or his/her duly authorized designee, will review the Bidder's appeal under GP-2.23(f) and respond to the Bidder in writing within twenty (20) Working Days of receipt of appeal. The CAO's, or his/her duly authorized designee's, written decision is final and binding on all involved parties.

GP - SECTION 3
AWARD AND EXECUTION OF CONTRACT

GP-3.01 AWARD OF CONTRACT (See GP-2.19)

Notice of Award shall be faxed, where available, at the number provided with the Bid and/or mailed, by first class mail, to the successful Bidder at the address submitted with the Bid. In addition, the Department's Division of Construction Contracts Administration shall maintain for public inspection a record of the date of the notice of Award for each Contract, if Awarded and as applicable.

(a) The notice of Award, if it be Awarded, shall be within ninety (90) Calendar Days (or as otherwise specified in the Contract) after the opening of the Bid, and will be to the Responsible Bidder with the lowest Responsive Bid whose Bid complies with all the requirements prescribed in these Standard Specifications and the Invitation for Bid. The successful Bidder will be notified by letter, as stated above, to the address shown on its Bid, that its Bid has been accepted and that it has been Awarded the right to execute the Contract Documents with the County. The notice of Award shall be deemed to have been received three (3) Calendar Days after the date on the notice of Award. The successful Bidder will also be deemed to be on notice of the information contained in the public record log referred to above.

(b) If a Contract is jointly Bid by more than one Person, all Persons will be, upon Award, notified and shall execute the Control thereafter and will be held jointly and severally responsible for the performance and Full and Final Completion of the entire Contract.

(c) The right is reserved to cancel and rescind any notice of Award at any time before the County fully executes the Contract Documents. Upon the County's cancellation and rescission of the notice of Award the County shall not be liable or obligated in any kind, nature or amount to any Person.

GP-3.02 RETURN OF PROPOSAL GUARANTY

If a Bid is withdrawn by Written Notice received in the office designated in the Bid Package before the time and date set for Bid opening, the Proposal Guaranty will be returned if requested. Each Proposal Guaranty submitted, other than the three low Bidders, will be considered released immediately following opening and review of the Bids. The Proposal Guaranty of the 2nd and 3rd low Bidders will be returned upon request only, following execution of the Contract with the lowest Bidder, and the Proposal Guaranty of the lowest Bidder (i.e., the Contractor) can only be released upon execution of the Contract and submittal of the Performance Bond and the Payment Bond by the Contractor, as required by GP-3.03.

GP-3.03 PERFORMANCE BOND AND PAYMENT BOND REQUIREMENTS

(a) Acceptable security in the County-required forms for the Performance Bond and a Payment Bond are included in the Bid Package.

(b) A Performance Bond and a Payment Bond must be provided by Contractor from a Surety acceptable to the County who is (1) licensed in the State of Maryland, (2) rated "B" or better by the A.M. Best Company, (3) on federal funded projects, authorized by the underwriting limitation contained in the U.S. Department of the Treasury Circular 570, as amended, to guaranty the amount of the Bid, and (4) in good standing as determined by the County's Engineer as amended at the time of the underwriting and provision of the Payment Bond and Performance Bond.

A Payment Bond and Performance Bond are required for every and each Contract in excess of twenty-five thousand dollars ($25,000). Each Payment Bond and each Performance Bond shall be in the amount equal to at least one hundred (100%) percent of the Contract price. The fully executed Payment Bond and fully executed Performance Bond shall be delivered by the Bidder to the Department's Division of Construction Contracts Administration no later than the time the Contract is to be executed by the Contractor. If the Bidder fails to deliver the required Payment Bond and the required Performance Bond in a timely manner, the Bid shall be rejected, the Proposal Guaranty shall be enforced, and Award of the Contract may be made to the Responsible Bidder with the next lowest Responsive Bid in accordance with the Invitation for Bid and these Standard Specifications.

All Bond premiums shall be paid by the Contractor. At the direction of the Department, the Contractor may be required to increase the Payment Bond and Performance Bond with such increase to be paid for by the County in the amount of the documented actual cost to the Contractor.

GP-3.04 EXECUTION OF CONTRACT/SUBMISSION OF REQUIRED DOCUMENTS AND MBE/WBE FORMS

The successful Bidder for the Contract will be provided, upon Award of the Contract, five (5) sets of Bid Proposal Forms and Plans and two (2) sets of cross sections free of charge (this number of copies may be increased to fifteen (15) for certain large building projects, in the sole discretion of the Administrator). Any additional Plan sets required by the Contractor may be purchased at the price noted in Bid Package. Individual Plan sheets or complete sets of Plans may be purchased at the prevailing price set by the County.

(a) Not later than ten (10) Business Days after the date of the notice of Award, the successful Bidder shall have obtained and returned the Contract Documents to the County and two (2) sets of cross sections, including, but not limited to: (1) the fully and properly executed Contract Proposal Form, (2) the fully and properly executed Payment Bond and Performance Bond, if required under GP-3.03, (3) the fully and properly completed evidence of insurance required pursuant to GP-7.14 of these Standard Specifications and the Bid Package, and (4) the Proposal Affidavit. The documents referred to in this GP-3.04 (a) (1), (2), (3), and (4) are to be delivered to the Department's Division of Construction Contracts Administration unless expressly specified otherwise by the Engineer or in the Contract Documents.

(b) The Department's Division of Construction Contracts Administration shall record in the public record log, referred to in GP-3.01, the date it received from the successful Bidder each of the properly completed Contract Documents required in GP-3.04 (a) (1), (2), (3), (4) and (5)

above, and the date it received notification from the County's Office of Fair Practices that the successful Bidder's MBE/WBE forms required by the County have been approved. The successful Bidder is deemed to be on notice of such information so recorded.

(c) In the event the County fails to fully execute the Contract Documents within thirty (30) Business Days after the date all of the required documents in this section have been received by the Department, the successful Bidder will have, as its sole remedy, the option to declare the Contract terminated or to agree to an extension of the time for the County to execute the Contract. Should Bidder declare the Contract terminated, in no event shall County be liable or obligated for any losses, costs, expenses or damages in any amount, nature, or kind incurred by any Person including, but not limited to, the Bidder. If the successful Bidder, however, shall fail within thirty-five (35) Business Days of the aforementioned date to deliver Written Notice to the Department's Division of Construction Contracts Administration that it elects to rescind its Bid and have the Contract terminated, the time period for the County to execute the Contract shall automatically be extended for an additional fifteen (15) Business Days.

(d) All Contract Documents remain the property of the County and must not be used on other work but shall be returned to the County upon request by Engineer.

GP-3.05 FAILURE TO EXECUTE CONTRACT

Failure to deliver to the County the required items listed in GP-3.04 within the time specified therein shall be just cause for the annulment and rescission of the notice of Award and the Contractor's and Surety's forfeiture of the Proposal Guaranty to the County, not as a penalty, but in liquidation of damages sustained. Notice of Award may then be made to the Responsible Bidder with the next lowest Responsive Bid, or, at the County's option, the Work may be re-advertised.

GP - SECTION 4
SCOPE OF WORK

GP-4.01 INTENT OF CONTRACT

(a) The Contractor shall (within specified tolerances) perform all Work in accordance with the Contract Documents including, but not limited to, the lines, grades, typical cross sections, dimensions, and other data shown on the Plans or as modified by Contract Modification including the furnishing of all Materials, implements, machinery, Equipment, tools, supplies, transportation, labor, and all other things necessary to the satisfactory prosecution and completion of the Work in full compliance with the Contract Documents.

(b) The Contract Documents are intended to be complementary, and to describe the Construction and completion of the Work. Anything mentioned in the Contract Documents and not shown on the Contract Drawings, or shown on the Contract Drawing, and not elsewhere

mentioned in the Contract Documents shall be of like effect as if it is shown or mentioned in both.

(c) Omissions from the Contract Documents including, but not limited to, Contract Drawings or the misdescription of details of Work which are manifestly necessary to carry out the intent of the Contract Documents and/or Contract Drawings or which are customarily performed shall not relieve the Contractor from performing such omitted or misdescribed details of Work, but they shall be performed as if fully and correctly set forth and described in the Contract Drawings and Contract Documents. The Engineer shall consider modifications of the Bid and/or postponement of Bid opening as may best serve all interested parties where Written Notice of apparent omissions is received by the Engineer five (5) Business Days before the hour prescribed for Bid opening. This is not to be construed as a limitation on the Engineer. If justified and deemed appropriate by the County, the Engineer may issue a Contract Modification or, if after execution of the Contract, prepare a Supplemental Agreement(s) for Extra Work that was not anticipated and/or shown on the Contract Drawings or described in the Contract Documents.

(d) Work described in words that have a well-known technical or trade meaning shall be held to refer to such recognized standard use.

(e) The Contractor shall keep in the office on the Work site a complete set of all Contract Drawings, Standard Specifications, shop drawings, schedules, etc., in good order and available to the Engineer and representatives of the County.

GP-4.02 CONTRACT DOCUMENTS

The Contract Documents are essential parts of the Contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete Work. In the event of any discrepancy between the drawing and figures written thereon, the figures, unless obviously incorrect, will govern over scaled dimensions. In the event of any discrepancy between the Plans and the Standard Specifications, the Plans will govern. If there is a discrepancy between the Standard Specifications and Interim Supplemental Specification, the Interim Supplemental Specifications will govern. Special Provisions will govern over Standard Specifications, Interim Supplemental Specification and Plans.

Special Provisions govern over all other Contract Documents unless expressly stated to the contrary in the Contract Documents.

GP-4.03 ENTIRE CONTRACT

The Contract represents the entire and integrated agreement between the parties thereto and supersedes all prior negotiations, representations or agreements, either written or oral.

GP-4.04 VARIATIONS IN ESTIMATED QUANTITIES

(a) Where the quantity of a Major Contract Item in this Contract is an estimated quantity and where the actual quantity of such Pay Item varies more than twenty-five (25%) percent above or below the estimated quantity stated in this Contract, an equitable adjustment in the Contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above one hundred twenty-five (125%) percent or below seventy-five (75%) percent of the estimated quantity. If the quantity variation is such as to cause an increase in the time necessary for completion, the Engineer shall, upon receipt of a written request for an extension of time within ten (10) Days from the beginning of the delay, or within a further period of time which may be granted by the Engineer before the date of final settlement of the Contract, ascertain the facts and make the adjustment for extending the Completion Date as in Engineer's judgment the findings justify.

(b) Should any Contract Items contained in the Bid Package be found unnecessary for the proper completion of the Work, the Engineer may, upon written order to the Contractor, eliminate such Contract Items from the Contract and no allowance will be made for Contract Items so eliminated in making final payment to the Contractor except for Material costs documented incurred prior to notification of the elimination of the Contract Items and for which there is no other possible or reasonable use.

GP-4.05 DIFFERING SITE CONDITIONS

(a) Pursuant to and incorporated GP-2.04, the Contractor is solely responsible for ascertaining soil conditions impacting any and all portions of the Work and soils testing shall be performed by an independent testing firm at Contractor's sole cost and expense. Unless waived in writing by the Engineer, the independent testing shall be performed by a professional engineer licensed by the State of Maryland. The Contractor shall promptly, and before such conditions are disturbed, notify the Engineer in writing of:

(1) Subsurface or latent physical conditions at the site differing materially from those indicated in this Contract; or

(2) Unknown physical conditions at the site of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in Work of the character provided for in this Contract. The Engineer shall promptly investigate the conditions, and if he finds, in his sole discretion, that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the Work under this Contract, whether or not changed as a result of such conditions, an equitable adjustment shall be made and the Contract modified in writing accordingly.

(b) No claim of the Contractor under this General Provision shall be allowed unless the Contractor has given the notice required in (a) above; provided however, the time prescribed therefor may be extended by the County, in its sole discretion.

(c) No claim by the Contractor for an equitable adjustment under this General Provision shall be allowed if asserted after final payment under this Contract.

GP - 4.06 CHANGES

(a) The Engineer may unilaterally, at any time, and without notice to the Surety, if any, by a Change Order, make any change in the Work within the general scope of the Contract, including but not limited to changes:

(1) In the Contract Documents (including, but not limited to, Contract Drawings and designs);

(2) In the method or manner of performance of the Work;

(3) In the County-furnished facilities, Equipment, Materials, services, or Work site; or

(4) Directing acceleration in the performance of the Work.

If the Contractor intends to assert an equitable adjustment claim under this GP-4.06(a) for changes made by the Engineer, it shall, within thirty (30) Days after receipt of a written Change Order submit to the Engineer a Written Notice setting forth the general nature and monetary extent of such claim for equitable adjustment and the Contractor's position relative to Contract Time, unless the Contract Time was already extended by the County.

(b) The Contractor may request a Change Order by providing the Engineer with Written Notice stating the date, circumstances, and the source of any written or oral order from the County causing the change in Work. Except for claims based on defective Contract Documents, no claim for any change under this GP-4.06(b) shall be allowed for any costs incurred more than twenty (20) Days before the Contractor gives Written Notice as required. Further, in the case of defective Contract Documents in the Bid Package for which the County is responsible, the equitable adjustment shall include any increased costs reasonably incurred by the Contractor in attempting to comply with such defective Contract Documents in the Bid Package.

If the Contractor intends to assert an equitable adjustment claim under this GP-4.06(b) for changes it requested, it shall, within thirty (30) Days after the furnishing of Written Notice submit to the Engineer a written statement setting forth the general nature and monetary extent of such claim and the Contractor's position relative to Contract Time, unless the Contract Time was already extended by the County. This statement of claim for equitable adjustment may be included in the Written Notice submitted pursuant to this GP-4.06(b).

The Engineer will consider the Written Notice provided, and all facts at hand or that can be readily obtained, without unduly delaying the Work, and:

(1) Where the Engineer finds the change presented by the Contractor would cause a difference in Contract cost or Contract Time, he/she will consider alternatives to minimize impacts in the Contract cost or Contract Time in the mutual interest of both parties and commit his final decision to writing in a Change Order; or

(2) Where the Engineer does not find in favor of the change presented by the Contractor, he shall commit his instructions to writing and direct the Contractor's and the Engineer's staff to proceed as if a force account, as further described in GP-9.02, were ordered to provide a record for later re-evaluation as to merits of the change and any adjustments that may be needed.

Both parties are duty-bound to minimize the accumulation of expenses during the time the Engineer requires to complete the evaluation required in this GP-4.06(b). Delay costs and time, to the extent judged reasonable and unavoidable, are to be considered in the Engineer's Change Order, if any.

(c) No order, statement, or conduct of the Engineer shall be treated as a change under this General Provision or entitle the Contractor to an equitable adjustment unless made in a properly authorized and executed Change Order or Contract Modification.

(d) Each Contract Modification or Change Order that affects Contract price, whether an increase or a decrease, shall be subject to the prior written approval of the Engineer and other appropriate authorities and to prior Certification of the County's Office of Budget and Finance of fund availability and the effect of the Contract Modification or Change Order on the Contract budget or the total Contract cost. If, according to the Certification of the County's Office of Budget and Finance, the Contract Modification or Change Order will cause an increase in Contract cost that will exceed budgeted and available funds, the Contract Modification or Change Order may not be made unless sufficient additional funds are made available or the scope of the Contract is adjusted to permit its completion within the Contract budget.

(e) No claim by the Contractor for an equitable adjustment hereunder shall be allowed if asserted after final payment is made pursuant to GP-9.04 and this Contract.

(f) No claim for Extra Work by the Contractor will be granted which includes cost of delays or Work stoppage due to strikes, lockouts, fire, avoidable casualties or damage or delay in transportation for which the County or its agents are not responsible.

GP-4.07 - NEGOTIATED PAYMENT PROVISION

(a) The County, without invalidating the Contract, may order changes in the Work by altering, adding to or deducting from the Work, the Contract amount being adjusted accordingly in a Change Order. Extension of time made, or if necessary thereby, shall be adjusted at and documented in a Change Order.

(b) The Engineer shall have the authority to make minor changes in the Work not involving extra cost and not inconsistent with the purpose of the Contract and/or Work. Otherwise, except in an emergency endangering life or property, no Extra Work or change shall be made unless a written order from the Department signed by the Director has been received by the Contractor. No claim for addition to the Contract sum shall be valid unless so ordered in writing by the Director.

(c) The value of any such Extra Work or change under this GP-4.07 shall be determined in one or more of the following ways as determined by the Department:

(1) **By Estimate and Acceptance of a Lump Sum**

(a) The Contractor shall furnish a breakdown of the estimated Construction cost. The breakdown shall be of sufficient detail to describe the Extra Work and related costs for labor, Material, overhead and profit.

(b) Overhead and Profit

1. Extra Work by Subcontractor:

Subcontractor will be allowed 10% overhead and 10% profit added to the direct labor and Material costs. The Contractor will be allowed to increase the Subcontractors total lump sum by 10% to cover its administration.

2. Extra Work by Contractor:

The Contractor will be allowed 10% overhead and 10% profit added to the labor and Material costs.

(c) The Contractor will be allowed 1% for Contract Bond added to the labor and Material costs, as applicable.

(d) The allowed overhead will include all supervision; no additional allowance will be made for it.

(2) **By Unit Prices Named in the Contract or Subsequently Agreed Upon**

Such unit prices are to include all supervision, overhead, taxes, insurance and profit.

(3) **By Cost and a Fixed Fee**

Added to the cost is a fixed fee portion that is to include supervision, overhead, insurance and profit.

(4) **By Force Account (Labor and Material Cost plus)**

See GP-9.02 entitled "Force Account Work".

Should none of the methods stated in Paragraph 4.07(c) 1, 2, or 3 be applicable, the Contractor shall, providing the Contractor receives an order as defined in Paragraph 4.07(b) of this General Provision, proceed with the Work in accordance with GP-9.02 entitled "Force Account Work". The Contractor and Engineer shall keep accurate costs, in such form as the Engineer may direct, for presentation, together with vouchers, to the Department for determination of the value of the Extra Work included in each Change Order. Pending determination of the final value and the execution of the Change Order, the Engineer may include payments for Materials and labor, as stated in General Provision - Section 9, "Payment", in monthly vouchers.

GP-4.08 UNAUTHORIZED WORK

Work done contrary to or regardless of the instructions of the Engineer, Work done beyond the lines and grades shown on the Contract Drawings, or as given, or any Extra Work done without written authority of the Engineer is unauthorized and at the sole cost and expense of the Contractor and will not be measured or paid for. Work so done may be ordered removed and/or replaced at the Contractor's sole cost and expense.

GP-4.09 FINAL CLEAN UP

Upon Final Acceptance for Maintenance of the Work specified in the Contract and before final payment will be made, the Construction area and all other adjoining areas occupied by the Contractor during the Construction of said Contract, other than those owned by the Contractor, shall be cleaned of all surplus and discarded Materials, spilled Materials, excess Materials left deposited on the permanent Work as a result of the Contractor's operations, falsework, and rubbish and temporary Structures and buildings, that were placed thereon by the Contractor. The adjoining areas mentioned above, outside the normal pay limits for seeding, will be reshaped, seeded and mulched, or otherwise restored as directed by the Engineer at the Contractor's expense.

GP-4.10 WARRANTY OF CONSTRUCTION

(a) In addition to any other warranties at law and specified in the Special Provisions of the Contract, the Contractor warrants for two (2) years after the date of Final Acceptance for Maintenance by the County, that Work performed under this Contract shall conform to the Contract requirements and is free of any defect of Equipment, Material or design furnished, or workmanship performed by the Contractor or any of the Contractor's Subcontractors or suppliers at any tier. Under this warranty, the Contractor at its own and sole cost and expense shall make any Repairs or replacements which, in the judgment of the Engineer, may become necessary during this warranty period on account of any failures or defects. In addition, the Contractor

shall remedy at its own and sole cost and expense any damage to County-owned or controlled real or personal property, when that damage is the result of the Contractor's failure to conform to Contract requirements or any such defect of Equipment, Material, workmanship, or design. The Contractor shall also promptly restore any Work damaged in fulfilling the terms of this General Provision. The Contractor's warranty with respect to Work Repaired or replaced hereunder will run for one (1) year from the date of the County's acceptance of such Repair or replacement; provided that the terms and conditions of all warranties in place following the Final Acceptance for Maintenance shall continue to remain in full force and effect.

(b) The County shall notify the Contractor in writing within a reasonable time after the discovery of any failure, defect, or damage.

(c) Should the Contractor fail to remedy any failure, defect, or damage described in (a) above within a reasonable time after receipt of notice thereof, or in the case of an emergency, the County shall have the right to replace, Repair, or otherwise remedy such failure, defect, or damage at the Contractor's sole cost and expense. To insure the County against the nonpayment of any such costs, on the date of Final Acceptance for Maintenance, the County will either require the retainage of five percent (5%) of the total value of the Contract or require the Contractor to submit a value equivalent maintenance bond. Said maintenance bond shall be in a form and with a Surety approved by the County, binding the Contractor as principal, and the Surety, to promptly and properly replace any improper Work or Materials that may become apparent within the two (2) year warranty period following the date of Final Acceptance for Maintenance. In lieu of a bond, other forms of security such as irrevocable letters of credit, or a bank cashier's or treasurer's check may be accepted. Upon acceptance and approval by the County of such a bond or other security, the sum retained by the County will be released pursuant to GP-Section 9.

(d) In addition to the other rights and remedies provided by this General Provision, all Subcontractors', manufacturers', and suppliers' warranties expressed or implied, respecting any Work and/or Materials shall, at the direction of the County, be enforced by the Contractor for the benefit of the County. In such case if the Contractor's warranty under (a) above has expired, any suit directed by the County to enforce a Subcontractor's, manufacturer's or supplier's warranty shall be at the expense of the County. The Contractor shall obtain any warranties that the Subcontractors, manufacturers, or suppliers would give in normal commercial practice.

(e) If directed by the Engineer, the Contractor shall require any such warranties under this GP-4.10 to be executed in writing to the County.

(f) Notwithstanding any other provision of this General Provision, unless such a defect is caused by the negligence of the Contractor or its Subcontractors or suppliers at any tier, the Contractor shall not be liable for the Repair or any defects of material or design furnished by the County nor for the Repair of any damage which results from any such defect in County furnished Material or design.

(g) The warranty specified herein shall not limit the County's rights under GP-5.13 "Acceptance for Maintenance", or any other rights available to County under the Contract, at law, and/or in equity.

GP - SECTION 5
CONTROL OF THE WORK

GP-5.01 AUTHORITY OF THE ENGINEER

(a) The Engineer shall decide: all questions which may arise as to the quality and acceptability of Materials furnished and Work performed and as to the rate of progress of said Work; all questions which may arise as to the interpretation of any or all Plans and Contract Documents; and all questions as to the acceptable fulfillment of the Contract on the part of the Contractor.

(b) The Engineer shall determine the amount and quantity of Work performed and Materials which are to be paid for under the Contract.

(c) The Engineer shall have the authority to suspend the Work wholly or in part due to the failure of the Contractor to carry out any provisions of the Contract.

GP-5.02 CONFORMITY WITH CONTRACT REQUIREMENTS

All Work performed and all Materials furnished shall be in conformity with the Contract requirements.

In the event the Engineer finds the Materials or the finished product in which the Materials are used or the Work performed are not in reasonably close conformity with the Contract requirements and have resulted in an inferior or unsatisfactory product, the Work or Materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor.

In the event the Engineer finds the Materials or the finished product in which the Materials are used are not in conformity with the Contract requirements but that acceptable Work has been produced, he shall then make a determination if the Work shall be accepted in the Engineer's sole discretion. In this event, the Engineer will document the basis of acceptance by a Change Order that will, if applicable, provide for an appropriate adjustment in the Contract price. Any action taken pursuant to this General Provision shall not result in an increase of the Contract price.

GP-5.03 DISCREPANCIES IN THE CONTRACT DOCUMENTS

In the event the Contractor discovers any discrepancies in the Contract Documents, the Contractor shall immediately notify the Engineer in writing. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the Contract.

GP-5.04 COOPERATION BY CONTRACTOR

The Contractor will keep available on the Work site at all times one complete set of Contract Documents.

The Contractor shall give the Work the constant attention necessary to facilitate the timely progress thereof, and shall cooperate with the Engineer and the Engineer's Inspector at all times and in every way possible.

The Contractor shall assign to the Contract as his agent, a competent Superintendent capable of communicating in English and capable of reading and thoroughly understanding the Contract Documents and thoroughly experienced in the type of Work being performed, who shall receive instructions from the Engineer or his authorized representatives. The Superintendent shall have full authority to execute the order or directions of the Engineer without delay, and to promptly supply such Materials, Equipment, tools, labor and incidentals as may be required. Such superintendence shall be furnished irrespective of the amount of Work sublet. Said Superintendent shall be on the Work site at all times when the Work is in progress.

The Contractor shall so schedule the Work as to ensure efficient and uninterrupted progress and to hold to an absolute minimum the cutting and patching of new Work. All cutting, patching and digging necessary to the execution of the Work is included in the Contract.

The Contractor shall so schedule (to include Subcontracts) the Construction performed by each group or trade that each installation or portion of the Construction shall member with and join with all other Work as required for a complete installation, all according to accepted good Construction practice.

The Contractor shall be responsible for the coordination of the Work of all Subcontractors.

GP-5.05 COOPERATION WITH UTILITIES

It is understood and agreed that the Contractor has considered in its Bid all of the permanent and temporary utility appurtenances in their present or relocated positions and that no additional compensation will be allowed for delays, inconvenience, or damage sustained by the Contractor due to any interference from the said utility appurtenances or the operation of moving them.

The Contractor shall have responsibility for notifying all affected Utility Companies before performing any Work on their utilities and shall cooperate with them. All damage to utility

facilities caused by the Contractor's operations shall be the sole financial and legal obligations, liability and responsibility of the Contractor.

MISS UTILITY: Sections 12-101, *et seq.*, of the Public Utility Companies Article of the Maryland Annotated Code, as amended from time to time, establish requirements regarding protection of existing underground utilities from excavation and demolition activities.

The Contractor shall notify Utility Companies and their public agencies at least forty-eight (48) hours but not more than ten (10) Days before digging. Locate requests may be processed through Ticket Check by calling this special toll-free number: 1-866-821-4226, where the caller will be prompted through the steps to retrieve ticket status, using a 10 digit Contractor's number. Contact the MISS UTILITY help desk at 410-712-0056, x4040 or check the www.missutility.net/maryland web site for more information on how to use the Ticket Check system.

One call to 1-800-257-7777 or use of Ticket Check will reach most companies and organizations that have underground facilities in the County. A list of member utilities belonging to MISS UTILITY is on the MISS UTILITY website at www.missutility.net/maryland. Other utilities, which are non-participants in MISS UTILITY, may also be encountered. It is the Contractor's responsibility to identify all utilities, to inform the proper authorities of Work near the utility line, and to exercise caution at all times in regard to them.

The UTILITY SERVICE PROTECTION CENTER (MISS UTILITY: (800 257-7777) may also be called between 7:00 a.m. and 5:00 p.m., Monday through Friday, excluding Holidays. Emergencies will be processed promptly on a 24-hour basis.

FIRE HYDRANTS: The Contractor shall notify the County Fire Department's Fire Dispatch Liaison Officer (410 887-4592) prior to starting any Work involving the removal or relocation of existing fire hydrants.

SANITARY SEWERS: To protect against accidental clogging, existing sanitary sewer channels shall be covered within manholes, as directed by the Engineer, prior to any grubbing or grading operations. This will not be a separate Pay Item, but shall be included in the cost of other Pay Items.

ADDITIONAL COSTS: The cost of charges for marking the locations for water and sewer utilities by the organizations which are part of the MISS UTILITY program shall be included as an incidental cost in the Contractor's Bid.

Water mains, gas mains, storm drains, sanitary sewers, and other utilities are shown on the Plans, in accordance with the best information available to the County, for the convenience of the Contractor. THE COUNTY ASSUMES NO RESPONSIBILITY FOR ACCURACY OR COMPLETENESS OF THE INFORMATION SHOWN ON THE PLANS AND THE CONTRACTOR SHALL BE FULLY AND SOLELY RESPONSIBLE FOR VERIFYING THE LOCATION OF ALL UTILITIES. Existing mains and services shall be carefully protected and any damage to them caused by the Work and/or the Contractor shall be immediately Repaired to

the satisfaction of the Engineer by the Contractor at its own expense, using Materials of the quality and kinds damaged.

GP-5.06 COOPERATION BETWEEN CONTRACTORS

(a) Each and every contractor under contract with the County, with regard to any adjoining or overlapping Work or work of or with another under contract with the County, shall cooperate with each other as necessary. Such cooperation shall include:

(1) Arrangement and conduct of Work and/or work; and

(2) Storage and disposal of Materials, etc., by each in such manner as to not unnecessarily interfere with or hinder the progress of the Work and/or work being performed by other contractors. Contiguous Work shall be joined in an acceptable manner.

(b) The Administration and Department shall have the right, at any time, to contract for and perform other Work and/or work on, near, over or under the Work covered by this Contract. In addition, other Work and/or work may be performed under the jurisdiction of another public body, public entity, the County agency or entity, County affiliate or any public educational or college entity. In such cases, when a dispute arises among one or more contractors, the Engineer will decide which department, body, or entity has jurisdiction over said dispute. The Contractor shall cooperate fully with such other contractors and carefully fit Contractor's own Work to such other work as may be directed by the Engineer.

(c) The Contractor agrees that in the event of dispute as to cooperation the Engineer will act as referee. The Contractor waives its rights and remedies to make a claim or take any other action of any kind against the Administration for any inconvenience, delay or loss experienced by Contractor because of the presence and operations of other contractors.

(d) The County reserves the right to let other contracts in connection with paving and utilities adjoining this Work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work, and shall properly connect and coordinate its Work with theirs.

If any part of the Contractor's Work depends for proper execution or results upon the work of any other contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such work that render it unsuitable for such proper execution and results. Failure to inspect and report shall constitute an acceptance of the other contractor's work as fit and proper for the reception of the Work. The Contractor shall take all reasonable precautions during construction to prevent damages to previously installed work. The Contractor shall monitor the previously installed area/work while performing its assigned Work, and shall advise the Engineer immediately if defects in that previously installed work become apparent.

To ensure the proper execution of Contractor's subsequent Work, the Contractor shall verify Work already in place and shall at once report to the Engineer any discrepancy between the executed Work and the Contract Drawings.

GP-5.07 AUTHORITY AND DUTIES OF INSPECTORS

The Inspector shall be authorized to inspect all Work done and all Material furnished. Such inspection may extend to all or any part of the Work and to the preparation, fabrication or manufacture of the Materials to be used. The Inspector is not authorized to revoke, alter or waive any requirements of the Contract, nor is he authorized to approve or accept any portion of the Work. The Inspector is authorized to call the attention of the Contractor to any failure of the Work or Materials to conform to the Contract. The Inspector shall have the authority to reject Materials or suspend the Work until any questions at issue can be referred to and decided by the Engineer. The Inspector shall perform his duties at such times and in such manner as will not unnecessarily impede progress on the Contract.

The Inspector shall in no case act as foreman or perform any other duties for the Contractor, nor interfere with the management of the Work by the Contractor. Any advice, instruction, direction or other order which the Inspector may give the Contractor shall not be construed as binding the Engineer in any way, or releasing the Contractor from fulfilling all of the terms of the Contract.

Where there is disagreement between the Contractor, the Superintendent, or any other contractor and the Inspector, such as refusal by the Contractor to use properly approved Material, performing Work not in compliance with Plans and Contract Documents, and/or refusing to suspend Work until problems at issue can be referred to and decided by the Engineer, the Inspector will immediately direct the Engineer's attention to the issues of disagreement. If the Contractor still refuses to make corrections and/or comply or suspend Work, as applicable, the Engineer may prepare and deliver in writing to the Contractor, by mail or otherwise, a written order suspending the Work and explaining the reason for such shutdown. As soon as the Inspector is advised of the delivery of the shutdown order, the Inspector shall immediately leave the site of the Work and any Work performed during the Inspector's absence will not be accepted or paid for and may, in the sole discretion of the Engineer be required to be removed and disposed of at the Contractor's sole cost and expense.

GP-5.08 INSPECTION OF WORK

All Materials and each part or detail of the Work shall be subject at all times to inspection by the Engineer and/or the Inspector, and the Contractor will be held strictly to the Materials, workmanship, and the diligent execution of the Contract. Such inspection may include mill, plant or shop inspection, and any Material furnished under the Contract is subject to such inspection. The Engineer and/or Inspector shall be allowed access to all parts of the Work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection of all parts of the Work.

If the Engineer requests it, the Contractor, at any time before Partial Acceptance for Maintenance and/or Final Acceptance for Maintenance of any Work, shall remove or uncover such portions of the finished Work as may be directed. After examination, the Contractor shall restore said portions of the Work to the standards required by the Contract. Should the Work thus exposed or examined prove acceptable, adjustments in Contract Time and price will be made pursuant to Section GP-4.06 for the uncovering or removing, and the replacing of the covering or making good of the parts removed. Should the Work so exposed or examined prove unacceptable, the uncovering, or removing and replacing, shall be at the Contractor's sole cost or expense.

When the United States Government, the State, another local government or municipality, or any railroad, corporation or other Person is to pay a portion of the cost of the Work covered by this Contract, their respective representatives shall have the right to inspect and approve the Work.

If the Contract Documents, the Engineer's instructions, laws, regulations, executive orders, ordinances, or any public authority require any Work to be specially tested or approved, the Contractor shall give the Engineer timely notice of its readiness for inspection, and if the inspection is by another authority, the date fixed for such inspection. Inspections by the Engineer shall be made promptly, and where practicable, at the source of supply. Any Work covered without approval of the Engineer must, if required, be uncovered for examination at the Contractor's sole cost and expense.

If initial tests and/or inspections show substandard products, Materials, workmanship, etc. and the Contractor elects, with the Engineer's approval, to perform additional tests and/or inspections to prove the acceptability of the substandard products, Materials, workmanship etc., the Contractor shall perform same at Contractor's sole cost and expense.

GP-5.09 REMOVAL OF DEFECTIVE WORK

All Work and Materials which do not conform to the requirements of the Contract will be considered unacceptable, unless otherwise determined acceptable under the provisions in GP-5.02.

Any defective Work, whether the result of poor workmanship, use of defective Materials, damage through carelessness or any other cause, found to exist shall be removed and replaced by Work and Materials which shall conform to the Contract Documents or shall be remedied otherwise in an acceptable manner authorized by the Engineer.

Upon failure on the part of the Contractor to comply promptly with any order of the Engineer made pursuant to these General Provisions, the Engineer shall have authority to cause defective Work to be remedied or removed and replaced and unauthorized Work to be removed and to deduct the costs from any monies due or to become due the Contractor under this Contract.

GP-5.10 LOAD RESTRICTIONS

(a) The Contractor shall comply with all applicable State and local laws, regulations and requirements pertaining to speed, size and weight of motor vehicles.

(b) The Administration may indicate in the Contract any load restrictions on any Road or Structure within the vicinity of the Work site.

(c) The Contractor shall take into account any and all posted Bridges, the crossing of which might be contemplated by the Work of the Contract. No loads in excess of posted limits will be allowed in the prosecution of the Work on any Contract, unless the required permits are obtained from the appropriate State and local governmental agencies.

(d) The Contractor shall consider possible detrimental effects of operating heavy paving and grading Equipment contiguous to retaining walls, pipe Culverts, arches, forms for concrete Work as well as any Construction existing prior to this Contract.

(e) The Engineer shall have the right to limit passage of heavy Equipment (plus loads) when such passage or usage is causing apparent or visible damage to embankments, paving, Structures or any other property.

(f) Within Baltimore City limits, and within the limits of the Baltimore City-maintained watershed properties, the Department of Transportation of the City of Baltimore has jurisdiction for oversize and overweight vehicle movements. Permits are obtainable from the Baltimore City Department of Transportation.

GP-5.11 MAINTENANCE OF WORK DURING CONSTRUCTION

(a) The Contractor shall maintain the Work during Construction and until Final Acceptance for Maintenance by the County. This maintenance shall constitute continuous and effective Work prosecuted as required with adequate Equipment and forces to the end that all parts of the Work be kept in satisfactory condition at all times.

The Contractor shall at all times keep the Work site free from accumulations of waste Material or rubbish caused by its employees, Subcontractors, or Work, and at the Final Acceptance for Maintenance of the Work, shall remove all rubbish, waste, Contractor's tools, scaffolding and surplus Material from and about the Work site. In case of dispute, the County may remove the waste and rubbish and charge the cost to the Contractor as the Engineer shall determine to be just, in his sole discretion.

All debris shall be kept sprinkled to reduce dust and shall be promptly removed from any Structure, and no combustible Materials shall be stored against perimeter walls of any Work.

The Contractor shall clean entirely any Structure as it is completed, wash all windows, scrub all floors at least once, and leave all floors free from spots and blemishes. The interior of any Structure and the entire Work site shall be left "broom clean," or its equivalent.

(b) Particular attention shall be given to drainage, both permanent and temporary. The Contractor shall use all reasonable precautionary measures to avoid damage or loss that might result from accumulations and concentrations of drainage water, and material carried by such water and such drainage shall be diverted or removed when necessary to prevent damage to excavation, embankments, surfacing, Structures or any other property. Suitable measures shall be taken by the Contractor to prevent the erosion of soil in all Construction areas where the existing ground cover has been removed and/or disturbed.

The Contractor shall remove all water, including rain water, encountered during the entire progress of the Work, using pumps, drains or other methods approved by the Engineer. Excavations and the Work site shall be kept free from water until all backfilling is completed. The water shall be discharged to catch basins, or other drainage points as directed by the Engineer.

(c) All cost of maintenance Work during Construction and before Final Acceptance for Maintenance by the County shall be included in the Bid and the Contractor will not be paid an additional amount for such Work, except as otherwise provided in the Contract Documents.

(d) In the event that the Contractor's Work is ordered to shut down for failure to comply with any provision of the Contract, the Contractor shall maintain the entire Work site as provided herein, and provide such ingress and egress for local residents or tenants adjacent to the Work site, for tenants of the Work site, and for the general public as may be necessary during the period of suspended Work or until the Contract has been declared in default.

(e) On Contracts where traffic flow is maintained, the Contractor shall be responsible for Repair of all traffic damages to the Work, either partially or totally completed, until Final Acceptance for Maintenance of the Work is achieved. Responsible, as used here, shall mean the responsibility for restoration and the cost thereof unless otherwise expressly provided for in the Special Provisions.

GP-5.12 FAILURE TO MAINTAIN ENTIRE PROJECT

Failure on the part of the Contractor, at any time, to respond to the provisions of GP-5.11 will result in the Engineer's immediately notifying the Contractor to comply with the required maintenance provisions. In the event the Contractor fails to proceed with corrections to unsatisfactory maintenance so as to conform to the provisions of GP-5.11 within four (4) hours after receipt of such notice, the Engineer may notify the Contractor to suspend all other Work on the Contract until the unsatisfactory maintenance is corrected. In the event that the Contractor has failed to commence with adequate corrective measures within four (4) hours after receipt of such notice the Engineer may immediately proceed with adequate forces and Equipment to maintain the Contract Work and the entire cost of this maintenance will be deducted from any monies due or to become due to the Contractor from the County. The Contractor is and remains responsible for any injury or damage that may result from lack of maintenance of any refilled excavation at any time until Final Acceptance for Maintenance by the County. The Engineer may suspend Work as further described in GP-8.07.

GP-5.13 ACCEPTANCE FOR MAINTENANCE

(a) **Partial Acceptance for Maintenance.** If at any time during the performance of the Work the Contractor substantially completes a unit or portion of the Work, the Contractor may request the Engineer to make final inspection of that unit or portion. If the Engineer determines upon inspection that the unit has been satisfactorily completed in compliance with the Contract, the Engineer may make a written Partial Acceptance for Maintenance of that unit or portion of Work, and the Contractor may be relieved of further maintenance responsibility for that unit or portion of Work. Generally, Partial Acceptance for Maintenance will only be considered when the Administration feels that such action is in the public interest. Such Partial Acceptance for Maintenance of any unit or portion of Work shall in no way void or alter any of the terms of the Contract.

(b) **Final Acceptance for Maintenance.** Upon due notice from the Contractor of presumptive completion of the Contract Work, the Engineer shall make a Construction inspection and if at such inspection all Construction and Contract Work provided for and contemplated by the Contract is found completed, such inspection shall constitute the final inspection and the Engineer shall make the Final Acceptance for Maintenance of the Work as of that date, and the Contractor shall be notified of such Final Acceptance for Maintenance in writing. After Final Acceptance for Maintenance, the Administration will assume responsibility for maintenance except where otherwise provided by the Contract.

(c) If, however, at any Construction inspection any Contract Work, in whole or in part, is found unsatisfactory, the Engineer shall give the Contractor the necessary instructions as to the Contract Work required for Final Acceptance for Maintenance by the County. The Contractor forthwith shall comply with and execute such instructions. Upon completion of such Contract Work, another inspection shall be made which shall constitute the final inspection if the said Contract Work is completed satisfactorily. In such event, the Engineer shall make the Final Acceptance for Maintenance and the Contractor shall be notified as aforesaid. After Final Acceptance for Maintenance, the Administration will assume responsibility for maintenance except where otherwise provided by the Contract.

(d) Unless otherwise provided in this Contract, Partial Acceptance for Maintenance and/or Final Acceptance for Maintenance by the County shall be made as promptly as practicable after completion and inspection of all Work required by this Contract, or that portion of the Work that the Engineer determines can be accepted separately. Partial Acceptance for Maintenance and/or Final Acceptance for Maintenance shall be final and conclusive except as regards latent defects, fraud, and such gross mistakes as may amount to fraud or the County's rights under any warranty or guarantee or any claims or counter claims reserved by the County.

(e) No claim for Extra Work will be granted which includes cost of delays or Work stoppage due to strikes, lockouts, fire, avoidable casualties or damage or delay in transportation for which the County or officials, employees, or its agents are not responsible.

GP-5.14 CLAIMS

Unless a shorter period is prescribed by law or elsewhere in this Contract:

(a) The Contractor shall file a Written Notice of claim for extension of time, equitable adjustment, extra compensation, damages, or any other matter (whether under or relating to this Contract) with the Engineer within ninety (90) Days after the basis for the claim is known or should have been known, whichever is earlier.

(b) Contemporaneously with or within ninety (90) Days of the filing of a notice of a claim, but no later than the date that final payment for the Pay Item and/or portion of the Work for which the claim is made, a Contractor shall submit the claim to the appropriate Engineer. The claim shall be in writing and shall contain:

(1) An explanation of the claim, including reference to all Contract provisions upon which it is based;

(2) The amount of the claim;

(3) The facts upon which the claim is based;

(4) All pertinent data and correspondence that the Contractor relies upon to substantiate the claim;

(5) A Certification by a legally authorized representative of the Contractor or Subcontractor, as applicable, that, to the best of the Person's knowledge and belief, the claim is made in good faith, supporting data are accurate and complete, and the amount requested accurately reflects the Contract adjustment for which the Person believes the Administration is liable; and

(6) Itemized supporting data for the elements of cost the Contractor claims to have incurred or which the Contractor will incur. This data shall be in sufficient detail to permit analysis by the Administration of Material, labor, Equipment, Subcontract and overhead costs as well as profit and shall include all Work covered by the claim, whether deleted, added, or changed. Subcontractors' costs shall be supported by similar detailed data.

(c) A notice of claim or a claim that is not filed within the prescribed time shall be dismissed.

GP-5.15 DISPUTES

(a) Except as otherwise may be provided by applicable law or regulation, all disputes arising under or as a result of a breach of this Contract that are not disposed of by mutual agreement shall be resolved in accordance with this General Provision.

(b) As used herein, "claim" means a written demand or assertion by one of the parties seeking, as a legal right, the payment of money, adjustment or interpretation of Contract terms, or other relief, arising under or relating to this Contract.

A voucher, invoice, or request for payment that is not in dispute when submitted is not a claim under this General Provision. However, if the submission subsequently is not acted upon in a reasonable time, or is disputed either as to liability or amount, it may be converted to a claim for the purpose of this General Provision.

(c) When a claim cannot be resolved by mutual agreement, the Contractor shall submit a written request for decision to the Department's Chief of the Division of Construction Contracts Administration, or other designated County official, for his decision in consultation with the County Office of Law. The Contractor's written request shall set forth all the facts surrounding the controversy, including, but not limited to, those items listed in GP-5.14(b). Any claim by the County shall be decided in like manner.

(d) The Contractor, at the discretion of the Engineer, may be afforded an opportunity to be heard and to offer evidence in support of his claim. Pending resolution of a claim, the Contractor shall proceed diligently with the performance of the Contract.

(e) The Department's Chief of the Division of Construction Contracts Administration, or other designated County official, shall decide any and all claims. The decision by the Department's Chief of the Division of Construction Contracts Administration, or other designated County official, shall be issued within ninety (90) Days on matters of less than fifty thousand dollars ($50,000) and within one hundred eighty (180) Days on matters of fifty thousand dollars ($50,000) or more. The written decision of the Department's Chief of the Division of Construction Contracts Administration, or other designated County official, shall be final and binding unless appealed in writing to the Director of the Department within thirty (30) Days of the Chief's, or other designated County official's, written opinion to the parties. If the Chief's, or other designated County official's, decision is timely appealed in writing to the Director of the Department, the Director of the Department, serving as referee, will review the written appeal submitted to assure all reasonable attempts were made to resolve the appeal.

(f) The Director shall issue his/her decision in writing within ninety (90) Days. The Director's decision shall be final and conclusive unless a written appeal is mailed or otherwise filed with the County Administrative Officer within thirty (30) Days of the Director's written decision.

(g) When the County Administrative Officer is satisfied all efforts at the Department level were made to resolve the dispute, a claim shall be resolved as follows:

(1) Subject to, and without in any way enlarging or limiting the other provisions of the Contract, the parties to any Agreement which adopts or incorporates by reference these Standard Specifications, appoint the County Administrative Officer as an administrative hearing

officer pursuant to Article 25A, "Chartered Counties of Maryland", of the Annotated Code of Maryland.

(2) The parties further grant the County Administrative Officer the right to delegate this responsibility and authority in writing to a County official who is a registered professional engineer, independent of the Department of Public Works's Division of Construction Contracts Administration, or to any other County official.

(3) For disputes involving ten thousand dollars ($10,000) or more the decision of the administrative hearing officer shall be final and binding on both parties, subject only to such appeals on the record as provided by Article 25A. For disputes involving less than ten thousand dollars ($10,000), the decision of the administrative hearing officer shall be final and binding on both parties.

GP - SECTION 6
CONTROL OF MATERIAL

GP-6.01 GENERAL

All Materials shall meet all quality requirements of the Contract. In order to expedite the inspection and testing of the Materials, the Contractor shall notify the Engineer in writing of the sources from which the Contractor proposes to obtain all Materials requiring approval, testing, inspection, or Certification prior to incorporation into the Work as soon as possible after receipt of notification of Award of the Contract.

To expedite the approval of this notice a list of Approved Sources of Supply is available through the Department's Division of Construction Contracts Administration. If all Materials are to be supplied from the sources on the Approved Sources of Supply list, no written notification to that effect is required unless specifically requested by the Engineer or required by the Contract. If other sources are to be used, they shall be submitted for approval to the Engineer. It shall be the Contractor's responsibility to insure that all Materials are supplied from approved sources. Once the source of concrete or bituminous concrete for exposed final surfaces has been selected, that source is to provide Material for all Construction of continuous surfaces on all of the Contract Work. Submittal of all sources of supply will still be required for contracts involving State or federal funding. The Engineer will inform the Contractor as to source acceptability as soon as possible.

GP-6.02 STORAGE AND HANDLING OF MATERIALS

Materials shall be stored so as to assure the preservation of their quality and acceptability for the Work. Stored Materials shall, at the discretion of the Engineer, be again inspected prior to their use in any Work even if approved before storage. Stored Materials shall be located so as to facilitate their prompt inspection. Approved portions of the Right-of-Way or Work site may be used for storage purposes and for the placing of the Contractor's plant and Equipment; such

storage areas must be restored to their original condition by the Contractor prior to Final Acceptance for Maintenance of the Work at Contractor's sole cost and expense. Any additional space required must be provided by the Contractor at Contractor's sole cost and expense.

Materials shall be handled in such a manner as to preserve their quality and acceptability for the Work.

GP-6.03 UNACCEPTABLE MATERIALS

(a) Materials represented by samples taken and tested in accordance with the County-specified tests and failing to meet required values shall be considered to be defective regardless of prior tests or approvals.

(b) Unless otherwise allowed by the Engineer as set forth below, defective Materials shall be removed from the Work site and any tags, stamps or other markings implying conformance with Contract Work removed for those Materials and returned to the Engineer or obliterated if located on the Materials.

(c) Where defects can be corrected, the Contractor may propose such corrective action as the Contractor deems appropriate to the Engineer. The Engineer may approve the corrective action but in so doing does not assume responsibility for the success thereof. Retests will be made to determine the acceptability of the Material after corrective measures have been taken by the Contractor.

(d) The cost of replacing, correcting and/or removal of defective Material will be the sole responsibility of the Contractor.

(e) The cost of Repairing or replacing Materials damaged by the installation, correction and/or removal of defective Materials will be the sole responsibility of the Contractor.

GP-6.04 ADMINISTRATION FURNISHED MATERIAL

The Contractor shall furnish all Materials required for Full and Final Completion of the Work, except those specified to be furnished by the Administration. Materials furnished by the Administration will be delivered or made available to the Contractor at the point or points specified in the Special Provisions. The cost of handling and placing all Materials, after they are delivered to the Contractor, shall be considered as included in the Contract price for the Contract Item in connection with which they are used.

The Contractor shall be held responsible for all Material delivered to Contractor, and deductions will be made from any monies due or to become due to the Contractor to make good any shortages and deficiencies, from any cause whatsoever, and for any damage which may occur after such delivery, and for any demurrage charges.

In cases where Materials are supplied by the Administration and incorporated in the Contract Work by the Contractor, Materials inspection and acceptance will not be prerequisite for Final Acceptance for Maintenance as the Work pertains to these Contract Items.

GP-6.05 MATERIALS

Materials include all manufactured products and all processed and unprocessed natural substances required for the Full and Final Completion of the Contract. The Contractor in accepting the Contract is assumed to be thoroughly familiar with the Materials required and their limitations as to use and requirements for connections, setting, maintenance and operation.

Materials testing shall be performed by an independent testing firm, paid for by the Contractor, which has previously been approved by the County and the Architect and/or Design Engineer. Certified copies of all such test reports shall be submitted to the Engineer for approval.

Whenever an article, Material or Equipment is specified and a fastening, furring, connection (including utility connections), bed or accessory is normally considered essential to its installation in good quality Construction, such shall be included as if fully specified. Nothing in the Contract shall be interpreted as authorizing any Work in any manner contrary to applicable law, codes or regulations. (See GP-7.01).

(a) Approval

All Materials are subject to the Engineer's and the Architect's and/or Design Engineer's approval as to conformity with the Contract Documents, quality, design, color, etc. No Work for which approval is necessary shall be contracted for, or used, until written approval is given by the Engineer and the Architect and/or Design Engineer. Approval of a Subcontractor, as such, does not constitute approval of a Material which is other than that included in the Contract Documents.

(b) New Materials

Unless otherwise specified, all Materials shall be new.

(c) Quality

Unless otherwise specified, all Material shall be of the best quality of the respective kinds.

(d) Samples

The Contractor shall furnish for approval all samples of the Materials as directed. The Work shall be the same as the approved samples.

(e) Painting and Color

The Architect and/or Design Engineer and the Contractor shall jointly prepare the paint and color schedules. The Architect and/or Design Engineer shall direct the exact color, texture and finish.

(f) Proof of Quality

The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of Materials either before or after installation. The Contractor shall pay for any tests as may be deemed necessary in relation to "Substitutions" as specified in GP-6.05(i).

(g) Contractor's Option

When several products or manufacturers are named in the Contract Documents for the same purpose or use, then the Contractor shall select any of those so named. However, all of the units of a thing required for a Contract must be the same in material and manufacture.

(h) "Or Equal", "Equal", "Approved Equal"

The above terms are used as synonyms throughout the Contract Documents. They are implied in reference to all named manufacturers. Only Materials that, in the opinion of the Engineer, are fully equal in all details of Construction, methods of assembly, finish and design quality will be considered. (See (a), (c), (e) and (i) of this General Provision)

(i) Substitutions

Should the Contractor desire to substitute another Material for one or more specified by name, the Contractor shall apply, in writing, for such permission from the Engineer and state the credit or Extra Work involved by the use of such Material. The Engineer will not consider the substitution of any Material different in type or Construction methods unless such substitution effects a benefit to the County. (See (a) and (d) of this General Provision.)

The Contractor shall not submit for approval Materials other than those specified, unless the Contractor concurrently submits a written statement explaining why such a substitution of Materials is proposed. Approval of a "substitute" material by the Architect and/or Design Engineer when the Contractor has not designated such Material as a "substitute," shall not be binding on the County nor release the Contractor from any obligations of the Contract, unless the Engineer and the Architect and/or Design Engineer approves such "substitutions" in writing.

(j) Storage

The Contractor shall confine apparatus and storage of Materials to the "off-Road" area delineated as the "limit of contract" or "limit of disturbance", as applicable. The Contractor shall not load or permit any part of any Structure to be loaded with a weight that will endanger the safety of any Structure or any part thereof.

GP-6.06 SALVAGE MATERIALS

For Contract Work that involves the renovation, repair, and/or improvement of an existing Structure, the County has the right to claim as salvage any equipment and/or materials removed under the Work of the Contract. Should such right of salvage be exercised by the County, through verbal notification to the Contractor, the Contractor shall be responsible for the removal, protection, and transport, intact, of all salvaged equipment and/or materials to one or more government locations as directed by the Engineer. The Contractor shall provide the County with five (5) days advance notice prior to delivery of any salvage item to the designated government location. Until such time that items claimed as salvage by the County are provided to the County, the Contractor shall move and neatly store said items in a dry, secure location at the Contract Work site approved by the Engineer. Any and all costs associated with salvage materials, including, but not limited to, removal, protection, transportation and storage, shall be included by the Contractor in its Bid and Bid Package, and there will be no additional payment of any kind by the County for salvage operations or salvage materials.

GP - SECTION 7
LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

GP-7.01 COMPLIANCE WITH LAWS

The Contractor hereby represents and warrants that:

(a) It is qualified to do business in the State of Maryland and that it will take such action as, from time to time hereafter, may be necessary to remain so qualified;

(b) It is not in arrears with respect to the payment of any monies due and owing the State or the County, or any department or unit thereof, including, but not limited to the payment of taxes and employee benefits, and that it shall not become so in arrears during the term of this Contract;

(c) It shall comply with all federal, State and local laws, regulations, codes, executive orders, and ordinances applicable to its activities and obligations under this Contract; and

(d) All requirements set forth in federal assistance instruments applicable to this Contract shall be satisfied. The Contractor understands and agrees that it is possible federal and/or State funds may be used in connection with the Contract. Accordingly, prior to commencing any and all Work under the Contract, the Contractor shall ascertain and verify if federal and/or State funds are to be used by the County. It is the Contractor's obligation to ascertain if the County will use any federal and/or State funds in connection with the Contract or any portion thereof. Further, it is the obligation of the Contractor and the Contractor understands and agrees that should any federal and/or State funds be used by the County in connection with the Contract, the Contractor shall adhere to and comply with all applicable federal and/or State laws, regulations, circulars, executive orders, procedures and guidelines, as and if applicable, as amended from time to time, at no additional cost or expense to the County.

GP-7.02 PERMITS AND LICENSES

(a) The Contractor shall procure at Contractor's sole cost and own expense such permits, licenses, insurances and governmental approval as may be necessary in order to comply with federal, State and local laws, ordinances, codes, executive orders and regulations in performance of the Contract. The Contractor shall further give any notices necessary and incidental to the due and lawful prosecution of the Contract.

(b) The cost incurred in compliance with all permits shall be incidental to and included in the Bid. Any required permits, licenses and governmental approvals desired by the Contractor for temporary Structures such as docks, piers, anchorages, etc. must be applied for and obtained by the Contractor at Contractor's sole cost and expense.

(c) Fire hydrant permits must be obtained if water is required from a hydrant. No water is to be drawn from a public fire hydrant except through a meter. Applications shall be made through the County Department of Permits, Approvals and Inspections (PAI), or any successor County department. All costs are considered incidental to the Bid, with the following exceptions:

The Department will issue a meter for fire hydrant utilization for performance of the Contract. At the request of the Contractor within five (5) Days of charging the lines the Engineer will issue the meter application to the Contractor without cost and there will be no charge for Contractor's water use recorded on the meter provided. Failure to return the meter in good condition, or utilization of the meter provided for any other purpose, will be grounds for assessment of replacement costs thereof and/or liquidated damages.

(d) A backflow valve must be used in drawing water from the metropolitan system for charging and testing new utilities.

(e) This General Provision only applies, in its entirety, to building Contracts. GP-7.02(e)(8), "Miscellaneous Permits" applies to all types of Contracts.

(1) **BUILDING PERMIT** – The County will obtain the building permit at no cost to the Contractor.

(2) **PERMANENT WATER AND/OR SEWER SERVICE** – The County will apply for the permanent water and/or sewer service and pay all related charges; i.e., water meter, water systems connection charge, water distribution charge and sewer systems connection charge. Total installation of the permanent water and/or sewer service is part of this Contract. Water and/or sewer service shall be installed by a County prequalified utility contractor.

(3) **PLUMBING PERMIT** – The Contractor shall apply for the plumbing permit; however, the County will pay all related charges and fees.

(4) **PERMANENT ELECTRIC SERVICE** – The Contractor shall apply for and pay for the electrical permit. The County shall obtain permanent gas and electric service from the applicable Utility Companies for the Work site at no cost to the Contractor.

The Contractor shall coordinate the installation of permanent gas and electric service with the applicable Utility Companies. Both the gas and electric services shall be activated at the same time under one account number showing the County as owner. The Contractor shall be responsible for payment of consumption charges for the use of gas and electric energy obtained through the permanent gas and/or electric service until Final Acceptance for Maintenance of the Contract Work or until agreed upon by the County in direct coordination with the Department's Building Services Division. Charges from the Utility Companies for removal of existing electric service will be paid by the County.

(5) **PERMANENT TELEPHONE SERVICE** – The County shall pay for the permanent telephone service and systems to and in any Contract building. The Contractor is responsible for supplying and installing all conduit, cables and junction boxes as shown on the Contract Drawings or as described in the Contract Documents.

(6) **CABLE** – The County shall pay for any permanent cable television service into any Contract building. The Contractor is responsible for supplying and installing the remaining Work as shown on the Contract Drawings or as described in the Contract Documents.

(7) **TEMPORARY SERVICES** – All temporary services, such as water, electric, telephone, etc., shall be the Contractor's entire responsibility.

The Contractor shall arrange for and pay for the installation of temporary connection to the County's water mains, including all incidental fees and expenses for water supply during Construction of the Contract Work, and shall pay for all water used. Wasting of County water will not be permitted.

The Contractor shall arrange for and pay for temporary electric light and power service required during Construction of the Contract Work, and shall pay for all electricity used. Gasoline or other torches for lighting will not be permitted.

The Contractor shall provide and pay for any other temporary services that may be required for the Full and Final Completion of the Contract Work.

The Contractor shall provide, at Contractor's sole cost and expense, all cold weather protection, temporary heat and fuel as necessary to carry on the Work expeditiously during inclement weather, to protect Work and Materials against injury from dampness and cold, to dry out the building, and to provide suitable Working conditions. Refer to other portions of these Standard Specifications and/or the Contract Documents for temperatures required for Work under the various trades.

The methods of heating and type of fuel and Equipment used shall be subject to approval by Engineer.

With special permission, obtained from the Engineer in writing, a permanent heating system may be used to dry out any Contract building and provide suitable working conditions in all or various parts thereof as soon as practicable. If used, the Contractor shall be

responsible for use of the permanent heating system for the purpose described and all costs of fuel, attendance, etc. in connection therewith shall be borne by the Contractor. Such use shall not relieve the Contractor of its responsibility to turn over the permanent heating system to County on the date of Final Acceptance for Maintenance in perfect condition, including the removal of all dust of Construction from air handling units, etc., the replacing of all filters, etc., nor shall it shorten the stipulated guarantee period which will commence upon the date of Final Acceptance for Maintenance by the County of the Work.

(8) **MISCELLANEOUS PERMITS** - The Contractor shall procure any and all necessary permits not previously mentioned and pay any and all related charges and fees required and incidental to the due and lawful prosecution of the Work.

(f) The Contractor shall give all notices and comply with all State and federal laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn and specified.

GP-7.03 INTELLECTUAL PROPERTY AND PATENTED DEVICES, MATERIALS AND PROCESSES

If the Contractor is required or desires to use any intellectual property right, design, device, propriety information, material, or process covered by letters of patent or copyright or any other intellectual property right, the Contractor shall provide for such use by suitable legal agreement with the patentee, license holder, or owner and a copy of such agreement shall be filed with the Administration. The Contractor and the Surety shall indemnify, protect and save harmless (and defend upon request) the County and its officials, employees, agents and any affected third party, or political subdivision from any and all claims, suits, demands, liabilities, actions, costs, and/or judgments including, but not limited to, attorneys fees, by reason of the use of any such patented design, proprietary information, device, trade secret, patent right or intellectual property right or design, device, material, or process, or any trademark or copyright.

GP-7.04 FEDERAL OR STATE PARTICIPATION

When the United States Government and/or the State pays all or any portion of the cost of a project, the Work shall be subject to the inspection of the appropriate federal or State agency. Such inspection shall in no sense make the federal or State government a party to this Contract, and will not interfere in any way with the rights of either party hereinunder.

GP-7.05 CONSTRUCTION SAFETY AND HEALTH STANDARDS

(a) It is a condition of this Contract, and shall be made a condition of each Subcontract entered into pursuant to this Contract, that the Contractor and any Subcontractor shall not require any laborer or mechanic employed in performance of the Contract to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health or safety, as determined under Construction safety and health laws, standards and regulations (Title 29,

Code of Federal Regulations, Part 1926, formerly Part 1518, as revised from time to time) promulgated by the United States Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standard Act, (83 Stat. 96) and under any Construction safety and health standards and regulations promulgated by the Commissioner of Labor and Industry in accordance with the Maryland Occupational Safety and Health Act and/or the Maryland General Assembly (as the same may be amended from time to time).

The Contractor and each Subcontractor shall permit inspection without delay and at any reasonable time on any premises where the Work is being performed by a federal or State inspector authorized to investigate compliance with the above mentioned federal and State statutes and regulations.

The Contractor further agrees to correct any violations found to exist during such inspection within a reasonable time after the issuance of any citation, unless the Contractor contests the validity thereof through the appropriate administrative and judicial process.

(b) The Contractor shall be responsible for gas detection in and ventilation of confined spaces.

When procedures require workers to enter confined spaces such as steel or concrete box section type Superstructures, the Contractor shall be cognizant of the potential health hazards, particularly when the interior is closed off at both ends.

It shall be the Contractor's responsibility to adhere to all applicable MOSHA regulations. The Contractor shall have available approved detecting devices and shall conduct tests for oxygen content and presence of gases, such as combustible gas, carbon dioxide, methane, carbon monoxide, and hydrogen sulfide whenever any fabrication, erection or inspection operations are to be performed within the confined spaces. The Contractor shall apply mechanical ventilation continuously to the confined space during occupancy to maintain the proper oxygen content. The Contractor shall conduct air tests periodically during the occupancy.

(c) The Contractor shall arrange for the erection and maintenance of temporary toilets equipped with running water and a drain connection for use of the Contractor's employees, Subcontractors, and/or agents, and County employees. These conveniences shall be erected and kept clean, neat and in good sanitary condition, as required by applicable law and/or regulation, until ordered removed by the Engineer.

In lieu of temporary toilets, the Contractor may install a portable chemical toilet at a location as approved by the Engineer.

The permanent plumbing fixtures to be constructed under the Contract shall not be used by any Person, under any circumstances, before Final Acceptance for Maintenance of the Contract by the County.

(d) The Contractor shall erect and properly maintain at all times as required by the conditions and progress of the Work, all necessary safeguards for the protection of workers and the public

and shall post danger signs warning against the hazards created by such features of Construction as protruding nails, hod hoists, well holes, elevator hatchways, scaffolding, window openings, stairways and falling material.

In an emergency affecting the safety of life, or of the Work, or of the adjoining property, the Contractor, without special instruction or authorization is hereby permitted to act, at the Contractor's discretion, to prevent such threatened loss or injury, and the Contractor shall so act, without appeal, if so instructed or authorized by the Engineer. Any compensation claimed by the Contractor on account of emergency Work shall be determined as outlined in GP-4.07.

GP-7.06 PUBLIC CONVENIENCE AND SAFETY

The Contractor at all times shall conduct the Work in such a manner as to ensure the least practicable obstruction to all forms of traffic. The convenience of the general public, tenants, and of the residents along and/or adjacent to the Work site shall be provided for as follows and as further directed by the Engineer:

(a) Equipment and/or Materials stored upon or about the Work site shall be placed so as to cause a minimum of obstruction to the public.

(b) Sprinkling shall be performed at the direction of the Engineer.

(c) The Contractor shall, unless otherwise specified, provide and maintain in passable condition such temporary access, Roads and Bridges as may be necessary to accommodate traffic diverted from the Work site under Construction, or using the project under Construction and shall provide and maintain in a safe condition temporary approaches to and crossings of the Work site.

(d) Existing facilities planned to be removed, but which might be of service to the public during Construction are not to be disturbed until other and adequate provisions are made.

(e) Existing mailboxes shall be maintained or reset in positions accessible to the public and to mail deliveries during Construction and subsequent to Construction in their final locations in a satisfactory condition.

(f) On facilities occupied by railroad or light rail stations, temporary platforms for the entrance and exit of passengers and/or freight to and from the railway cars shall be provided and maintained in an approved manner by the Contractor and the applicable railroad/agency.

(g) Fire hydrants on or adjacent to the Contract Work site shall be kept accessible to fire apparatus at all times, and no material or obstruction shall be placed within fifteen (15) feet of any such hydrant. Work closed down for the winter or at any other times shall be left entirely accessible at all points to fire apparatus.

(h) All footways, gutters, storm drainage and portions of the Contract Work site adjoining the Work under Construction shall not be obstructed more than is absolutely necessary. The Engineer, in cooperation with the Sediment Control Inspector, shall specify that drainage inlets in sumps where there is potential for localized flooding shall have flow restrictions removed in the event of a predicted significant rainfall event.

GP-7.07 DETOURS

Detours may be indicated in the Contract Documents, or at the Contractor's request traffic may be detoured over County-approved routes along existing Roads, as determined acceptable by the Department's Bureau of Traffic Engineering and Transportation Planning. Detours over existing Roads will be designated, marked and maintained by the Contractor.

GP-7.08 BARRICADES AND WARNING SIGNS

The Contractor shall provide, erect and maintain all necessary barricades, suitable and sufficient lights, danger signals, signs and other traffic control devices, and shall take all necessary precautions for the protection of the Work and safety of the public. All Highways and other County facilities closed to vehicular traffic shall be protected by effective barricades, and obstructions shall be illuminated during hours of darkness with electric lights. The Contractor shall erect warning signs in advance of any place on the Work site where operations may interfere with the use of the facility by vehicular traffic, and at all other points where the new Work crosses or coincides with an existing Roadway or traffic lane(s). Such warning signs shall be constructed and erected in accordance with the MUTCD for Street and Highways, or as directed by the Engineer.

The Contractor shall furnish, erect and maintain warning and direction signs in the number required by the Engineer and at locations designated by the Engineer throughout the limits of the Contract Work site.

For street and Highway type traffic, the signs shall conform in every respect to the requirements of the MUTCD for Streets and Highways. Signs must be freshly painted and adequately reflectorized before being placed on any Contract Work site. No Work may be performed or begun unless an adequate number of signs of the proper category are in place.

In cases where the Contractor's sequence of operations results in grade differentials that would be hazardous to vehicular traffic the Contractor shall, at the direction of the Engineer, provide suitable substantial traffic barriers to the extent determined by the Engineer.

GP-7.09 FLAGGING OF MOTOR VEHICLE TRAFFIC

For all Construction Contracts requiring the flagging of motor vehicles licensed for operation on the Highways of the State, said flagging shall be conducted as specified in the MUTCD for Streets and Highways.

GP-7.10 MAINTENANCE OF TRAFFIC

Unless otherwise noted in the Special Provisions, it shall be the Contractor's responsibility to maintain pedestrian and vehicular traffic safely, adequately and continuously on all portions of existing facilities affected by the Contractor's Work. In addition to existing facilities undergoing improvement, this also applies to crossroads, approaches, crossovers and entrances affected or made necessary by the Contractor's Work.

GP-7.11 PRESERVATION AND RESTORATION OF PROPERTY OUTSIDE OF RIGHT-OF-WAY

(a) The Contractor shall not enter upon public or private property (outside of the Right-of-Way or Contract Work area as shown on the Contract Drawings) for any purpose without obtaining prior written permission from any applicable property owners. The Contractor shall be responsible for the preservation of all public and private property, trees, property pipes, monuments, signs and markers and fences thereon, and shall use every precaution necessary to prevent damage or injury thereto. The Contractor shall take suitable precaution to prevent damage to underground or overhead public utility structures. The Contractor shall carefully protect all survey land monuments and property marks located on the Contract Drawings or found in the Work site from disturbance. No alteration or damage thereto shall occur until survey references are established by a licensed surveyor at Contractor's sole cost and expense. If any land monuments and/or property marks are damaged or disturbed, they shall be reset by a licensed surveyor at the Contractor's sole cost and expense.

(b) The Contractor shall be responsible for all damage or injury to property of any character during the prosecution of the Work, resulting from any act, omission, neglect or misconduct in the Contractor's manner or method of executing said Work, or at any time due to defective Work or Materials, and said responsibility shall not be released until Final Acceptance for Maintenance of the Work is achieved. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect or misconduct in the execution of the Work or in consequence of the nonexecution thereof on the part of the Contractor, the Contractor shall restore, at the Contractor's sole cost and expense, such property to a condition similar to, or equal to, that existing before such damage or injury, in an acceptable manner to the County and/or applicable property owner. In case of the failure on the part of the Contractor to restore such property or make good such damage or injury, the Engineer may, upon forty-eight (48) hours notice to the Contractor, proceed to Repair, rebuild or otherwise restore such property as may be deemed necessary, and the cost and expense thereof will be deducted from any monies due or which may become due the Contractor under this Contract. If the property damage results in a public safety issue, in the sole discretion of the County, the

Contractor shall restore immediately or the County shall do so at Contractor's sole cost and expense.

(c) The Contractor should be aware of the potential of cultural resources on the Contract Work site. During the Construction phase, whenever anything that might appear to be a cultural resource of an historical, archeological, or paleontological nature is encountered, such an object shall not be disturbed. Work shall be stopped and rescheduled in a way that shall avoid not only the objects encountered but also the area of discovery and the Engineer shall be notified in writing at once. The Engineer will arrange for the evaluation of the situation by the appropriate authorities and for the ultimate disposition of the matter, taking the evaluation of the situation by the appropriate authorities into consideration.

(d) All trees along the way of access and all trees surrounding any Contract building which are liable to injury by the moving, storing and working up of Materials shall be boxed. No permanent tree shall be used for attachment of any ropes or derricks. Every public way, catch basin, conduit, tree, fence or things injured in carrying out this Contract, shall be replaced and put in good condition by the Contractor at no cost or expense to the County, unless the same shall be permanently done away with by written order of the Engineer.

GP-7.12 LAND, AIR AND WATER POLLUTION

(a) The Contractor shall incorporate all permanent erosion control features into the Work at the earliest practicable time as required by the Contract Documents. Temporary pollution control measures will be used to correct conditions that develop during Construction that were not foreseen during design; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal Construction practices, but are not associated with permanent control features on the Contract.

(b) The Contractor's attention is directed to the fact that temporary pollution control may include control measures outside the Right-of-Way or Contract Work site where such Work is necessary as a direct result of Contract-required Construction. The Engineer shall be kept advised of all such off-site control measures taken by the Contractor. This shall not relieve the Contractor of the basic responsibilities for such Work.

(c) In case of failure on the part of the Contractor to control erosion, pollution or siltation, the Engineer reserves the right to employ outside assistance or to use County forces to provide the necessary corrective measures. All costs and expenses incurred by the Engineer in the performance of such duties for the Contractor shall be withheld from monies due or becoming due to the Contractor.

(d) The Contractor and the Contractor's suppliers must submit evidence to the Administration that the governing federal, State and local air pollution laws, regulations and criteria will be met. This evidence and related documents will be retained by the Administration for on-site evaluation.

GP-7.13 RESPONSIBILITY FOR DAMAGE CLAIMS

(a) The Contractor shall indemnify and save harmless the County and all of its officials, agents, employees and representatives from all suits, actions, or claims of any character, including, but not limited to, all the costs of defense, brought on account of any injuries or damages sustained by any person or property in consequence of any neglect in safeguarding the Work, and/or through the use of unacceptable Materials in the Construction of the Contract Work, and/or on account of any act or omission by the said Contractor in the performance of the Contract, and/or as a result of faulty, inadequate or improper temporary drainage during Construction, and/or on account of the use, misuse, storage or handling of explosives, and/or on account of any claims or amounts recovered for any infringement of intellectual property, patent, trade secret, proprietary information, trademark, or copyright, and/or from any claims or amounts arising or recovered under the workers' compensation laws, and/or any other State or local law, executive order, charter, bylaw, code, ordinance, regulation, order or decree whether caused by or resulting from the act, omission, neglect, or misconduct of the Contractor, or its employees, agents, or Subcontractors, at any tier. The Contractor shall be responsible for any and all damage or injury to property of any character during the prosecution of the Work resulting from any act, omission, neglect or misconduct, in the manner or method of executing said Work satisfactorily or due to the nonexecution of said Work or at any time due to defective Work or Materials and said responsibility shall continue until Full and Final Completion of the Contract. The obligation of the Contractor to the County and all of its officials, agents, employees and representatives to indemnify, defend, and save harmless shall not apply if resulting from the sole negligence of the County.

(b) The Contractor shall conduct its operations upon the right-of-way of any applicable railroad company fully within the rules, regulations and requirements of the railroad company including, but not limited to, any additional flagging, insurance, inspection, and/or permit requirements. The Contractor shall be responsible for acquainting itself with such requirements as the railroad company may demand.

(c) The Contractor shall be held solely responsible for any accidents that may happen to the railroad company as a result of its operations.

(d) In accordance with GP-7.15, the Contractor shall not be held responsible for any claims arising from accidents incurred because of any traffic or general use permitted during the time the Construction Work site or any section thereof is open to traffic except from accidents which are attributable to the Contractor's, or the Contractor's employee's, Subcontractor's or agent's, acts or omissions or negligence.

GP-7.14 LIABILITY INSURANCE

Prior to the start of the Work on the Contract, or prior to the execution of the Contract if permitted by the County, the Contractor shall submit to the Department's Division of

Construction Contracts Administration, an evidence of insurance certificate indicating that the following insurance is carried:

"Comprehensive general public liability and property damage insurance" in the amounts of at least five hundred thousand dollars ($500,000) for the death of or injury to any person, each occurrence. Such insurance shall protect the Contractor from claims which may arise out of, or result from, the Contractor's operations under the Contract, whether such operations be by the Contractor, any Subcontractor, or anyone directly or indirectly employed by the Contractor or Subcontractor, or anyone for those acts any of the above may be liable. Minimum coverages to be included: "independent contractor's coverage"; "completed operations and products liability coverage"; and "contractual liability coverage". "Damages not to be excluded insurance" shall contain no exclusions applying to operations by the Contractor or any Subcontractor in the performance of the Contract pertaining to: (1) collapse of, or structural injury to, any Contract building or Structure; (2) damage to underground property; or (3) damage arising out of blasting or explosion and, where applicable, (4) removal of asbestos/lead or debris and building products containing asbestos/lead, transportation and disposal of asbestos/lead and contaminated materials.

"Automobile liability insurance" shall include "bodily injury liability" and "property damage liability" for a combined single limit of five hundred thousand dollars ($500,000) any one accident. Such insurance shall provide coverage for all Contractor owned, non-owned and hired automobiles.

"Workers' compensation and employers' liability insurance" must contain statutory coverage, including "employers' liability insurance" with limits of at least for "bodily injury by accident" – two hundred fifty thousand dollars ($250,000) each accident; "bodily injury by disease" – two hundred fifty thousand dollars ($250,000) each employee; and "bodily injury by disease" – five hundred thousand dollars ($500,000) policy limit.

Any policy exclusions must be shown on the face of the evidence of insurance.

When specified in the Contract Documents, the Contractor shall carry the type and amounts of insurance in addition to any other forms of insurance or bonds required under the terms of the Contract and the Contract Documents.

The cost of the insurance will be incidental to the Contract lump sum price for mobilization, or if that is not identified, to the other Contract Items specified in the Contract Documents.

Contractor shall procure **"railroad public liability and property damaged insurance"** and this insurance shall be provided by the Contractor as specified in TC-6.03.

The Contractor and its insurer shall immediately notify in writing the Department's Division of Construction Contracts Administration in the event that the Contractor's insurance coverage lapses for any reason.

Unless previously waived in writing by the Engineer, the Contractor shall, at the Contractor's sole expense and cost, insure the Work and keep it insured at all times during the Contract term and period of Construction, and until Final Acceptance for Maintenance of all Contract Work by the County, against loss or damage covered by an "all risk" builders risk type of policy. The amount of insurance shall be the one hundred percent (100%) estimated replacement cost of the Work.

The policies shall name the County and the Contractor as certificate holder and shall name the County as an additional insured in accordance with the requirements of the Contract Documents, as their interest may appear, and the policies shall be left in the possession of the Engineer, prior to the start of Construction.

GP-7.15 USE AND POSSESSION PRIOR TO FULL AND FINAL COMPLETION

(a) The Administration shall have the right to take possession of or use any completed or partially completed part of the Work. Such possession of or use shall not be deemed Partial Acceptance for Maintenance and/or Final Acceptance for Maintenance of any Work not completed in accordance with the Contract. While the Administration is in such possession, the Contractor shall be relieved of the responsibility for loss or damage to that portion of the Work in possession of the Administration, other than that resulting from the Contractor's fault, omission, act, or negligence. If such prior possession or use by the Administration delays the progress of the Work or causes additional expense to the Contractor, the Contractor shall provide the Administration with immediate Written Notice thereof to allow possible equitable adjustment in the Contract price or the time of completion. If necessary, an equitable adjustment will be made and the Contract shall be modified pursuant to a Contact Modification accordingly.

(b) Under this GP-7.15, only upon the prior written authorization of the Engineer may the Contractor be relieved of maintenance during the time the County has taken possession. Any portion of the Work that may be disturbed or damaged shall be restored at respective Contract prices for Contract Items involved, or on the basis of a predetermined arrangement entered into by the Contractor and Engineer before the performance of the restoration Work.

GP-7.16 CONTRACTOR'S RESPONSIBILITY FOR WORK

(a) Except as herein elsewhere provided, until Final Acceptance for Maintenance of the Work by the Administration, the Contractor shall have the charge and care thereof and shall take every reasonable precaution against injury or damage to any part thereof by the action of the elements, or from any other cause, whether rising from the execution or from the nonexecution of the Work. The Contractor, except as herein elsewhere provided, shall rebuild, Repair, restore, and make good all injuries or damages to any portion of the Work occasioned by any of the above causes before the Final Acceptance for Maintenance and shall bear the expense thereof. Material lost or Structures damaged as a result of faulty temporary drainage during Construction or the action of the elements shall be replaced or Repaired by the Contractor at no cost, expense, or delay to the Administration. The Contractor shall make good or replace at the Contractor's

cost and expense, and as otherwise required, any Administration-furnished Material which may be broken, lost through fire, theft, or otherwise damaged, or in any way made useless for the purpose and use intended subsequent to delivery to the Contractor by the Administration and prior to Final Acceptance for Maintenance of the Work by the County even though such breakage, damage, loss or uselessness may result from causes beyond the control of the Contractor.

(b) In case of suspension of Work for any cause whatever, the Contractor shall be responsible for the Contract Work and Work site and shall take such precautions as may be necessary to prevent damage to the Work and the Work site, provide for normal drainage, and shall erect any necessary temporary Structures, signs, or other facilities at the Contractor's cost and expense. During such period of suspension of Work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established plantings, seedings, and soddings furnished under this Contract, and shall take adequate precautions to protect new growth and other important vegetative growth against injury.

GP-7.17 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICES

At points where the Contractor's operations are adjacent to properties of railway, telegraph, telephone, power companies, and/or Utility Companies or are adjacent to other property, damage to which might result in expense, loss or inconvenience, Work shall not be commenced until all arrangements necessary for the protection thereof have been made between the Contractor and the property owner and/or affected Person.

The Contractor shall cooperate with the owners of any underground or overhead utility lines in their removal and rearrangement operations in order that these operations may progress in a reasonable manner, that duplication or rearrangement Work may be reduced to a minimum and that services rendered by those parties will not be unnecessarily interrupted.

In the event of interruption to utility services as a result of accidental breakage or as a result of being exposed or unsupported, the Contractor shall promptly notify the proper authority and shall cooperate with the said authority in the restoration of service. No Work shall be undertaken around fire hydrants until provisions for continued service have been approved by the local fire authority.

GP-7.18 PERSONAL LIABILITY OF PUBLIC OFFICIALS

In carrying out any of the provisions of the Contract, or in exercising any power or authority granted to them by or within the scope of the Contract, there shall be no liability upon the Administrator, Engineer or other County officials, employees, agents and/or authorized representatives, either personally or as officials, employees, or agents of the County, it being understood that in all such matters they act solely as agents and representatives of the County.

In addition, the Engineer and all of Engineer's representatives shall be held harmless, free of liability and duress, in the exercise of their duties and obligations as Inspector, administrator, witness, referee, mediator, and arbiter by both parties in their mutual best interest.

GP-7.19 NO WAIVER OF LEGAL RIGHTS

The Administration shall not be precluded or estopped by any measurement, estimate, or Certificate made either before or after the Partial Acceptance for Maintenance and/or Final Acceptance for Maintenance of any Work and payment therefore by the County, from showing the true amount and character of the Work performed and Materials furnished by the Contractor, nor from showing that any such measurement, estimate or Certificate is untrue or is incorrectly made, nor from showing that the Work or Materials do not in fact conform to the Contract. The Administration shall not be precluded or estopped, notwithstanding any such measurement, estimate or Certificate and payment in accordance therewith, from recovering from the Contractor or its Sureties, or both, such damage as it may sustain by reason of Contractor's failure to comply with the terms of the Contract. Neither the acceptance by the Administration, or any representative of the Administration, nor any payment for or acceptance of the whole or any part of the Work, nor any extension of time, nor any possession taken by the Administration, shall operate as a waiver of any portion of the Contract or of any power herein reserved, or of any right to damages.

No failure or delay by the County to insist upon the strict performance of any term, condition or covenant within the Contract, or to exercise any right, power, or remedy consequent upon a breach thereof, shall constitute a waiver of any such term, condition, or covenant or of any such breach, or preclude the County from exercising any such right, power, or remedy at any later time or times. Further, the express written waiver of any breach of the Contract shall not be a waiver of any other or subsequent breach of the Contract.

GP-7.20 NONDISCRIMINATION IN EMPLOYMENT

(a) The Contractor shall agree to the following conditions during the performance of its Contract with the County:

(1) To comply with all applicable federal, State, and County laws, regulations, codes, circulars, and executive orders;

(2) Not to discriminate in any manner against an employee or applicant for employment because of race, color, religion, creed, age, sex, marital status, national origin, ancestry, or physical or mental handicap unrelated in nature and extent so as reasonably to preclude the performance of such employment;

(3) To include a provision similar to that contained in GP-7.20 (a)(2), above, in any Subcontract except a Subcontract for standard commercial supplies or raw Materials;

(4) To post and to cause Subcontractors to post in conspicuous places available to employees and applicants for employment, notices setting forth the substance of this GP-7.20;

(5) In all solicitations or advertisements for employees placed by or on behalf of the Contractor, to state that all qualified applicants will receive consideration for employment without regard to sex, race, creed, color or national origin;

(6) If requested by the County to furnish a compliance report concerning its employment practices and policies in order for the County to ascertain compliance with the provisions of this Contract concerning nondiscrimination in employment; and

(7) To include the provisions outlined in this GP-7.20 pertaining to nondiscrimination in employment in every Subcontract or purchase order it uses in order to carry out the terms and conditions of the Contract so that such nondiscrimination in employment provisions are binding on each Subcontractor or vendor.

(b) In the event of the Contractor's noncompliance with the nondiscrimination provisions of this GP-7.20 and/or the Contract, the County shall impose such sanctions as it may determine to be appropriate, including but not limited to:

(1) Withholding of payment to the Contractor under the Contract until the Contractor complies; and/or

(2) Cancellation, termination or suspension of the Contract in whole or in part.

(c) Contractors providing Materials, Equipment, supplies, or services to the County under this Contract herewith assure the County that they are conforming to the provisions of the Civil Rights Act of 1964 and Section 202 of the Executive Order 11246 of the President of the United States of America as amended by Executive Order 11375, as applicable and as may be amended from time to time.

GP-7.21 SANCTIONS UPON IMPROPER ACTS – Reserved.

GP-7.22 NONHIRING OF EMPLOYEES

No official or employee of the County or any unit, department or agency of the County, whose duties as such official or employee include matters relating to or affecting the subject matter of this Contract, shall, while so appointed and/or employed, and during the pendency and/or term of the Contract, become or be an officer or employee of the Contractor.

GP-7.23 CHOICE OF LAW

The Parties hereby agree that:

(a) This Contract was made and entered into in Maryland, and under the laws, regulations, codes, and executive orders of the County and the State, as applicable.

(b) The laws, regulations, codes and executive orders of the County and the State shall govern the resolution of any issue arising in connection with this Contract including, but not limited to, all questions concerning the validity of this Contract; the capacity of the parties to enter therein; any modification or amendment thereto; and the rights and obligations of the parties hereunder.

GP-7.24 CONTINGENT FEE PROHIBITION

(a) The Contractor warrants that it has not employed or retained any Person, partnership, corporation, or other entity, other than a bona fide employee or agent working for the Contractor, to solicit or secure this Contract, and that it has not paid or agreed to pay any Person, partnership, corporation, or other entity, other than a bona fide employee or agent, any fee or any other consideration contingent on the making of this Contract.

(b) For a breach or violation of this warranty, the Administration shall have the right to terminate this Contract without liability, or, in its discretion, to deduct from the Contract price or consideration, or otherwise recover, the full amount of such fee, commission, percentage, brokerage fee, gift or contingent fee.

GP-7.25 MULTI-YEAR CONTRACTS CONTINGENT UPON APPROPRIATIONS

– Reserved.

GP-7.26 COST AND PRICE CERTIFICATION – Reserved.

GP-7.27 CORPORATE REGISTRATION AND TAX PAYMENT CERTIFICATION

– Reserved.

GP-7.28 BUY AMERICAN STEEL ACT

The Provisions of COMAR 21.11.02 pertaining to implementation of the "Buy American Steel" Act (Subtitle 3 of Title 17 of the State Finance and Procurement Article of the Annotated Code of Maryland), as amended from time to time, are incorporated in this Contract by reference.

GP-7.29 MINORITY BUSINESS ENTERPRISE AND WOMEN BUSINESS ENTERPRISE

It is the policy of the County that MBE and WBE, as defined by the most recent County Executive Order, and as further described in the Contract Documents, shall have the maximum opportunity to participate in the performance of capital improvement contracts financed by County capital funds and/or County operating funds in accordance with the most recent County Executive Order. The Contractor shall comply with all MBE/WBE requirements as set forth in the Contract Documents.

GP-7.30 PREVAILING WAGE CONTRACTS FOR PUBLIC WORKS

(a) The Provisions of Subtitle 2 of Title 17 of the State Finance and Procurement Article of the Annotated Code of Maryland, as amended, and COMAR 21.11.11, as amended, pertaining to the Prevailing Wage for Public Works are incorporated in construction contracts of five hundred thousand dollars ($500,000) or more by reference, if and as applicable.

(b) When all or a portion of the cost of a contract is funded by the U.S. Government, and the cost of the contract exceeds two thousand dollars ($2,000), among other legal requirements, the minimum wage rates and benefits paid to workmen under the contract shall be those prevailing in the locality, as predetermined by the Secretary of Labor pursuant to the Davis-Bacon Act (40 USC 276a to a-7), as amended from time to time, and regulations (29 CFR, Part 5) promulgated thereunder, as amended from time to time. Davis-Bacon rates applicable to this Contract, if any, may be specified elsewhere in the Contract Documents.

GP-7.31 SMALL BUSINESS PROCUREMENTS – Reserved.

GP-7.32 FINANCIAL DISCLOSURE – Reserved.

GP-7.33 POLITICAL CONTRIBUTION DISCLOSURE

The Contractor affirms that it is aware of, and will comply with, the provisions of Sections 14-101 through 14-108 of the Election Law Article of the Annotated Code of Maryland, as amended from time to time, which requires every Person who makes, during any 12-month period, one or more contracts, with one or more State governmental entities involving cumulative consideration, of at least one hundred thousand dollars ($100,000.00), to file with the State Board of Elections certain specified information to include disclosure of attributable political contributions in excess of five hundred dollars ($500.00), during defined reporting periods.

GP-7.34 CONFLICT OF INTEREST LAW

It is unlawful for any County official, employee, or agent to participate personally in his/her official capacity through decision, approval, disapproval, recommendation, advice, or investigation in any contract or other matter in which he or she, his or her spouse, or his or her dependent child has a financial interest or to which any firm, corporation, association, or other organization in which he or she has a financial interest or in which he or she is serving as an officer, director, trustee, partner, or employee is a party, or to which any person with whom he or she is negotiating or has any arrangement concerning prospective employment, is a party, unless such official, employee, or agent has previously complied with the provisions of Article 7 of the Baltimore County Code, 2003, as amended.

GP-7.35 PRE-EXISTING REGULATIONS – Reserved.

GP-7.36 RETENTION OF RECORDS

(a) Except as otherwise expressly stated in this General Provision and the Contract Documents, the Contractor shall retain and maintain all records and documents including, but not limited to, cost or pricing data, relating to this Contract for three (3) years after final payment by the County under the Contract or any applicable statute of limitations, whichever is longer, and shall make them available for inspection and audit by authorized representatives of the County, including the Engineer or his designee at all reasonable times. Should the Contract involve use of State or federal funds, the Contractor shall retain and maintain, all records and documents including, but not limited to, cost or pricing data, relating to this Contract for not less than ten (10) years after final payment by the County under the Contract or any applicable statute of limitations, whichever is longer.

(b) The Contractor shall include the provisions of GP-7.36(a) in every Subcontract.

GP-7.37 RESPONSIBILITY FOR RIGHT OF WAY

(a) The Right-of-Way (or Work site) as shown on the Contract Drawings has been, or will be, secured by the County.

(b) The Contractor shall not move any Equipment or Material in or on the Right-of-Way until authorized to do so by the Engineer. The Contractor shall confine its operations strictly within the limits of the Rights-of-Way shown in the Contract Documents unless the Contractor obtains the prior written permission of any applicable property owner of such additional lands as Contractor proposes to occupy. A copy of the written permission will be furnished to the Engineer before Contractor enters said property.

(c) Unless otherwise provided in the Contract Documents, trees with a butt diameter in excess of three inches (3"), measured three feet (3') above the ground, shall not be felled or damaged by the Contractor in a Right-of-Way identified as a Construction Strip. Should the Contractor obtain written permission of any applicable property owner to fell a tree or trees with

a diameter greater than three inches (3") from a Construction Strip, Contractor shall provide a copy of the written permission to the Engineer before Contractor enters said property and/or fells such tree(s).

(d) Unless otherwise provided in the Contract Documents, all trees may be felled with the permission of the Engineer in those Rights-of-Way identified as a Highway Right-of-Way or a slope, utility or drainage Easement.

(e) Unless otherwise provided in the Contract Documents, the Contractor is to preserve and protect, remove and replace, or restore fences, mail boxes, Sidewalks, driveways, shrubs, perennial plants, or other private improvements in Rights-of-Way identified as Construction Strips or Easements of any kind.

(f) The Contractor shall not enter upon public or private property (outside of the Right-of-Way or Contract Work area as shown on the Contractor Drawing) for any purpose without obtaining prior written permission from any applicable property owners and shall be responsible for the preservation of all public and private property, trees, property pipes, monuments, signs and markers and fences thereon, and shall use every precaution necessary to prevent damage or injury thereto. The Contractor shall take suitable precaution to prevent damage to underground or overhead public and private utility structures. The Contractor shall carefully protect from disturbance all survey land monuments and property marks located on the Contract Drawings or found in on, or at the Work site. No alteration or damage thereto shall occur until survey references are established by a licensed surveyor at Contractor's sole cost and expense. If any land monuments and/or property marks are damaged or disturbed, they shall be reset by a licensed surveyor at the Contractor's sole cost and expense.

(g) Upon Final Acceptance for Maintenance of the Work by the County, the Contractor shall restore the Rights-of-Way provided to a condition equivalent to that originally encountered, unless improved by the Work completed or as specified by the Contract. Property used by the Contractor under letter of permission or property that has been damaged shall be restored pursuant to GP-7.11 and the applicable letter of permission or to the satisfaction of the property owner without any cost or expense to the County.

(h) No arrangements will be made by the County for rights-of-way or rights of access beyond those shown in the Contract Documents. Any and all expense or costs relative to additional rights-of-way, rights of ingress and egress, or any other supplemental property rights beyond those described in the Contract Documents are considered to have been accounted for in the Bid.

GP-SECTION 8
PROSECUTION AND PROGRESS

GP-8.01 SUBCONTRACTING

(a) **Utilities and/or Highways Contracts.** Except as may be provided elsewhere in the Contract, the Contractor to whom a utilities and/or Highways Contract is Awarded shall perform with its own organization and with the assistance of workmen under the Contractor's immediate supervision, Work of a value of not less than fifty percent (50%) of the total Bid value of the Contract. The Director may permit the Contractor to sublet or Subcontract Work in excess of the fifty percent (50%) limitation where it is determined by the Engineer that the best interest of the County will be promoted thereby. The execution of Work by a subsidiary of the Contractor is not considered to be Work performed by the Contractor under this GP-8.01(a). The Contractor shall not assign any monies due or to become due to the Contractor hereunder, without the previous written consent of the County.

The Engineer's consent to Subcontract shall not be construed to relieve the Contractor or its Surety of any responsibility for the fulfillment of all the requirements of the Contract.

Unless required by the County pursuant to GP-8.01(e) or unless specified in the Contract Documents, Subcontractors undertaking a portion of Work under a utilities or Highways Contract in accordance with GP-8.01(a) (less than fifty percent (50%) of the Bid value) do not require Department approval.

When required, the Contractor shall give assurance that the minimum wage for labor, as specified in the Contract Documents, shall apply to labor performed on all Work sublet, subcontracted, assigned or otherwise disposed of in any way under a utilities or Highway Contract.

(b) **Buildings Contracts.** Except as may be provided elsewhere in the Contract, the contractor to whom a buildings Contract is Awarded shall perform with its own organization, and with the assistance of workmen under the Contractor's immediate supervision and with Materials directly purchased and paid for by the Contractor, Work of a value of not less than ten percent (10%) of the total Bid value of the Contract. Costs for insurance, overhead, and supervisions may not be claimed as a portion of the ten percent (10%) or more of the Work. The execution of Work by a subsidiary of the Contractor is not considered to be Work performed by the Contractor under this GP-8.01(b). The Contractor shall not assign any monies due or to become due to the Contractor hereunder, without the previous written consent of the County.

The Engineer's consent to Subcontract shall not be construed to relieve the Contractor or its Surety of any responsibility for the fulfillment of all the requirements of the Contract.

Unless required by the County pursuant to GP-8.01(e) or unless specified in the Contract Documents, Subcontractors undertaking a portion of Work under a building Contract in accordance with GP-8.01(b) (less than ten percent (10%) of the Bid value) do not require Department approval.

When required, the Contractor shall give assurance that the minimum wage for labor, as specified in the Contract Documents, shall apply to labor performed on all Work sublet, subcontracted, assigned or otherwise disposed of in any way under a building Contract.

(c) **All Contracts.** The Contractor shall not assign any of its obligations, responsibilities, or liabilities under any portion of the Contract except with the express prior written consent of the Engineer. Any assignment of any of the Contractor's obligations responsibilities, or liabilities under any part of the Contract without the express prior written consent of the Engineer shall be null and void. Along with any applicable legal documentation to be signed by all applicable parties, any approved assignee must provide the County with (1) an executed Contract specifying the Contract Items and dollar volume of the Work to be performed by the assignee, (2) a Payment Bond and a Performance Bond as required pursuant to GP-3.03, and (3) a certificate of insurance as required pursuant to GP-7.14.

(d) **All Contracts.** For **purposes of documentation and the County's file**, the Contractor shall provide the County with Written Notice of all Subcontractors' names, and the amount or percent of the Bid value of the Contract and/or the Contract to be performed by each named Subcontractor, at or before time of Notice to Proceed.

(e) **All Contracts.** At any time after the County's issuance of the Bid Package, the County expressly reserves the right, for **purposes of County approval and/or rejection**, to require the Contractor to provide the County with Written Notice of all Subcontractors' names, and the amount or percent of the Contract to be performed by each named Subcontractor, and the names for such material men, suppliers, and others as the Engineer may direct, within ten (10) Business Days upon request by the County therefore. The Engineer shall review the Contractor's Written Notice under this GP-8.01(e) in a timely manner and inform the Contractor in writing of those Subcontractors approved by the Engineer for use on the Contract. If any Subcontractor is rejected in writing by the Engineer, such Subcontractor shall not work on the Contract Work. Prior to any Engineer approval, the Engineer may request the Contractor and any Subcontractor to meet additional criteria as specified by the Engineer in writing or in a Contract Modification. If the County requests Written Notice under this GP-8.01(e), the Contractor shall employ only those Subcontractors as may be approved in writing by the Engineer. No substitutions or further Subcontracting shall be employed by the Contractor without prior written approval from the Engineer. Approved Subcontractors shall not Subcontract principal or important parts of their Work, as determined in the County's sole discretion, without the Engineer's prior written approval.

The Engineer's approval of a Subcontractor under this GP-8.01(e) is only for Work to be prosecuted under the Contract and said approval is not applicable to any other contract with the County.

The Engineer reserves the express right to revoke approval of any Subcontractor for that Subcontractor's breach of any Contract provision, including, but not limited to, GP-8.06.

The Contractor agrees to be fully responsible to the County for the acts and omissions of its employees, Subcontractors and, of Persons either directly or indirectly employed by Contractor, and their respective employees and agents. The Contractor shall not assign this responsibility to any Person, except as provided in GP-8.01(c).

The Contractor shall incorporate by reference or otherwise include these General Provisions in every Subcontract issued pursuant to or under this Contract, and shall require that the same reference or inclusion be contained in every Subcontract entered into by any of its Subcontractors, at any tier.

(f) **All Contracts.** The Contractor agrees to bind every Subcontractor and every Subcontractor agrees to be bound by the terms of the Contract, the Standard Specifications, the Standard Details, the Special Provisions, the Contract Drawings and the Contract Documents, as far as applicable, to the Work.

The Subcontractor agrees to be bound to the Contractor by the terms of the Contract, the Standard Specifications, the Standard Details, the Special Provisions, the Contract Drawings and the Contract Documents and to assume towards the Contractor all obligations and responsibilities that the Contractor, by those documents, assumes towards the County.

The Contractor agrees to be bound to the Subcontractor by all the obligations the County assumes to the Contractor under the Contracts, the Standard Specifications, the Standard Details, the Special Provisions, the Contract Drawings, and the Contract Documents and by all the provisions thereof affording remedies and redress to the Contractor from the County.

(g) **All Contracts.** The Contractor shall pay its Subcontractors:

(1) Upon receipt of payment, as described in Section GP-9.03, the amount allowed to the Contractor on account of that Subcontractor's Work, to the extent of that Subcontractor's interest herein.

(2) Upon the receipt of payment, if issued otherwise than as described in Section GP-9.03, so that at all times the total payments shall be as large in proportion to the value of the Work done by the Contractor as the total amount certified to the Contractor is to the value of the Work done by that Subcontractor.

(3) To such extent as may be provided by the Contract Documents or any related Subcontracting documents, if either of these provides for earlier or larger payments than described in GP-8.01(g)(1) and (2).

(4) On demand for that Subcontractor's Work or Materials as far as executed and fixed in place, less the retained percentage, at the time the payment is requested, even though the Engineer fails to approve it for any cause not the fault of that Subcontractor.

(5) To give that Subcontractor an opportunity to be present and to submit evidence in any manner involving that Subcontractor's rights under the Contract.

The Contractor and the Subcontractor agree that nothing in this GP-8.01(g) shall create any obligation on the part of the County to pay any Subcontractor or to see to the payment of any sums to any Subcontractor. County has no obligation or liability of any kind, nature or amount to any Subcontractor. Nothing contained in the Contract, or any related Subcontracting

documents, shall create any contractual relationship between any Subcontractor, materialman, supplier, and/or other party and the County.

GP-8.02 NOTICE TO PROCEED

(a) Unless otherwise stated in the Contract Documents, upon execution of the Contract and within ninety (90) Calendar Days from the date of Award, the Department's Division of Construction Contracts Administration will issue to the Contractor a "Notice to Proceed" and this notice will stipulate when the Contractor is expected to begin Work. The specified Contract Time shall begin on the date stipulated in the Notice to Proceed or, if an earlier start is authorized in the Notice to Proceed, on the Day Work (other than the erection of the inspection office, Construction stakeouts and mobilization) actually starts. Work done prior to receipt of the Notice to Proceed is unauthorized and will not be measured or paid for.

(b) If the County is unable to issue the Notice to Proceed within ninety (90) Calendar Days from the Award of the Contract, and the County has not yet executed the Contract, the Contractor may request that the County rescind the Notice to Proceed, it being mutually understood that in such instance and upon such rescission, the County shall have no further obligation or liability to Contractor of any nature, kind or amount. If the County is unable to issue the Notice to Proceed within ninety (90) Calendar Days from the Award of the Contract, and the Contract was executed by the Contractor and the County, the Contractor may request that the County rescind the Contract, it being mutually understood that in such instance and upon such rescission, the County's obligations and liabilities shall be limited to the net documented cost of Materials actually fabricated and/or delivered to the Work site of the Contract preauthorized in writing by the Engineer. The County's remedies shall be in accordance with the Contract Documents, at law and/or in equity.

(c) The County has no obligation or duty to remit payment for any Materials prior to the County's execution of the Contract. Any Material paid for by the County after a notice of Award will become the property of the County.

(d) **Emergency Roster.** Each successful Contractor must furnish the Engineer with the names, addresses and telephone numbers of at least two (2) members of the Contractor's organization who may be contacted in an emergency.

GP-8.03 PROSECUTION OF THE WORK/DETERMINATION & EXTENSION OF CONTRACT TIME

(a) The Contractor shall begin Work promptly within the time specified by the Engineer in the Notice to Proceed and shall notify the Engineer at least forty-eight (48) hours before starting Work. The Contractor shall complete the Work and achieve Full and Final Completion within the number of Working Days, Calendar Days or Calendar Date, as specified in the Contract.

The Engineer will make available to the Contractor each week a record showing the number of Days charged to the Contract for the preceding week. The Contractor will be allowed one week in which to protest and thirty (30) Days in which to file a written statement, setting forth in what respects time charges are incorrect.

(b) If Full and Final Completion of the Contract, including all extensions and increases authorized under GP-4.04 and changes specified in the General Provisions and Interim Supplemental Specifications, requires the performance of Work in greater quantities than specified in the Contract, as determined by the Engineer, the Contract Time allowed for Contract performance may be adjusted based on the quantities, cost and the nature of the Work involved.

(c) The Contractor, under certain conditions, may be granted permission or ordered to suspend operations as defined in GP-8.07 "Suspension of Work". On a Working Day Contract, if the Contractor elects and is permitted by the Engineer to do any Work during a suspension period, the Working Days charged shall be based on the "daily value" of the Contract, which shall be calculated as the Bid price of the Contract divided by the number of Working Days allowed by the Contract Time. At the end of each month during any suspension period, the amount of money earned for that month will be divided by the "daily value" (as defined above) to determine the number of Working Days to be charged for that month (number of Working Days to be rounded down). However, the resultant number of Working Days to be charged for any particular month will never exceed the number of Calendar Days for that month, excluding Saturdays, Sundays or Holidays on which no Work was performed by the Contractor on a Pay Item and/or a Controlling Operation.

Time used in performing Work of an emergency nature ordered by the Engineer for the convenience of the traveling public or for the production or delivery of Materials for storage, if performed during the period of suspension, will not be charged against the Contract Time.

(d) Following the date on which Partial Acceptance for Maintenance has been achieved for all Work, except those landscaping Contract Items on which Work is restricted to specified seasons and when inspection and Final Acceptance for Maintenance is being deferred pending completion of those landscaping Contract Items because such Work is currently out of season, and for no other reason, no time will be charged against the Contractor until such time as it is again permissible to proceed with such landscaping Work. However, time will be charged during any extensions of the specified season documented by the County and which may be granted the Contractor.

(e) **Prosecution of the Work shall not be discontinued without the prior written approval of the Engineer.** After the Work has started, the Contractor shall prosecute the Work continuously within the Contract Time without stoppage until Final Acceptance for Maintenance of all Contract Work is achieved **and** the Contractor achieves Full and Final Completion.

(f) Should the prosecution of the Work for any reason be discontinued without the prior written approval of the Engineer, the Contractor shall immediately notify the Engineer in writing of Contractor's intention to stop and the County may exercise any and all rights pursuant to the Contract, at law and/or equity.

GP-8.04 PROGRESS SCHEDULE REQUIREMENTS

(a) General.

(1) Scheduling of Construction is the responsibility of the Contractor. The Contractor must take all reasonable action to avoid or to mitigate the effects of delays including, but not limited to, rescheduling or resequencing the Work, accepting other work, and reassigning personnel. When the Contractor is responsible for any delays, the County may order the Contractor to accelerate Construction, work overtime, add additional shifts or manpower, work on weekends, or to do anything else reasonably necessary to achieve Full and Final Completion of the Work within the Contract Time, at no additional cost to the County.

(2) The Contractor shall submit to the County for review and approval a baseline schedule, monthly progress schedules, and any required recovery schedules as outlined in this GP-8.04.

(3) Failure of the Contractor to comply with the requirements of this GP-8.04 shall be grounds for determination by the County that the Contractor is not prosecuting the Work with due diligence as to ensure Full and Final Completion of the Work within the Contract Time specified in the Contract Documents or as agreed upon with the County after execution of the Contract. Based on this determination, the County may terminate the Contractor's right to proceed with the Work, or any separable part thereof, in accordance with GP-8.08 of these Standard Specifications.

(4) The Contractor does not have the unilateral right to complete the Work late and to then pay liquidated or other damages as a proposed remedy to this lateness.

(b) Baseline Schedule.

(1) Within thirty (30) Days after the Award of the Contract, the Contractor shall submit to the Department a detailed baseline schedule indicating the time allocated by the Contractor for performance of each portion of the Work. The baseline schedule shall show commencement of Work from the date the Notice to Proceed is issued. The baseline schedule shall show Full and Final Completion of the Work within the Contract Time as specified in the Contract or as mutually agreed upon with the County in writing pursuant to a Contract Modification after execution of the Contract.

(2) The submitted baseline schedule shall be properly and reasonably sequenced to show the order of performing the various tasks of Work. The baseline schedule shall clearly identify the sequencing restraints and the critical activities necessary to complete the Work and achieve Full and Final Completion of the Work within the Contract Time, and shall list proposed Work Days, Holidays and any special non-Work Days.

(3) The submitted baseline schedule shall list the dollar value for each Contract Item and shall show the Contractor's labor requirements for achieving each Contract Item. The baseline schedule shall also include a list of submittals related to Material and Equipment fabrication orders, permits, Easements and any other Work tasks requiring submittals. Each necessary submittal shall be shown on the baseline schedule as a separate Work activity with necessary dates of submittal, anticipated review and response time, anticipated dates of re-submittal if necessary, and anticipated dates for final review and approval.

(4) Within fourteen (14) Calendar Days after the Engineer reviews and rejects or conditionally approves the submitted baseline schedule, the Contractor shall make all necessary corrections and resubmit the corrected baseline schedule. The County may decline to issue a Notice to Proceed until the Contractor submits the required baseline schedule in form and content acceptable to the County in the County's sole discretion.

(c) **Monthly Progress Schedules.**

(1) Within thirty (30) Days after the County issues Notice to Proceed, and on a monthly basis thereafter, the Contractor shall submit a monthly progress schedule accurately updated to reflect Contract Work performed to date since the previously submitted monthly progress schedule including, but not limited to, actual commencement dates of listed Work activities, actual Work activities completed to date, and any sequence changes made or planned for the order of Work activities and their effect on the critical path for Full and Final Completion of the Contract. The sequencing changes shall show extension of times granted in a Contract Modification by the County and any delays or early completion of Work activities.

(2) The Contractor shall, and it is the Contractor's obligation to, meet with the Engineer, or his designee, at least once a month to discuss in detail the Contractor's updating of the monthly progress schedule and the necessity for revision or correction in the monthly progress schedule.

(3) Within ten (10) Calendar Days after the County reviews and rejects or conditionally approves the submitted monthly progress schedule, the Contractor shall make all necessary corrections and resubmit the corrected monthly progress schedule in form and content acceptable to the County in the County's sole discretion.

(4) The Contractor shall submit the required monthly progress schedule whether or not the Contractor submits an application for payment each month. The County may decline to process any pending payment requests under the Contract unless and until the Contractor submits the required monthly progress schedule in form and content acceptable to the County, in the County's sole discretion, and the Engineer approves such schedule in writing.

(d) **Recovery Schedules.**

(1) At all times during the Contract term, within ten (10) Calendar Days after the Contractor falls behind a baseline schedule or a monthly progress schedule, or is alleged by the County to be behind a baseline schedule or a monthly progress schedule, the Contractor shall

furnish to the County, at no additional cost, a recovery schedule. The recovery schedule shall show how the Contractor will finish the Contract Work and achieve Full and Final Completion by the Contract Date.

(2) The recovery schedule shall include all of the information required under GP-8.04(c).

(e) **Logical Sequencing and Layout of the Submitted Schedules (CPM Schedules).**

(1) Unless the Contract Documents expressly permit the Contractor to use a type of schedule other than a Critical Path Method (CPM) schedule, the submitted baseline schedule, the monthly progress schedules, and any required recovery schedules shall all be CPM schedules.

(2) CPM schedules are required to assure and to monitor the Contractor's adequate planning and execution of the Work and to assist in the County's evaluation of the Contractor's progress of the Work and the impact on the Completion Date.

(3) The submitted CPM schedules shall clearly designate the dates of Final Acceptance for Maintenance and Full and Final Completion of the Contract Work. **THE CONTRACTOR'S ACHIEVEMENT OF FINAL ACCEPTANCE FOR MAINTENANCE DOES NOT RELIEVE THE CONTRACTOR OF ANY OBLIGATION OR RESPONSIBILITY TO ACHIEVE FULL AND FINAL COMPLETION OF ALL CONTRACT WORK BY THE COMPLETION DATE.**

(4) As part of the CPM schedule format, the Contractor shall include logic or network diagrams showing the order and interdependence of activities and the sequence in which Work is to be accomplished as planned by the Contractor. These diagrams must show how the start of a given activity is dependent on preceding activities and how its completion restricts the start of the following activities.

(5) At a minimum, the following information shall be furnished for each Work activity in any and all schedules provided under this GP-8.04:

i. Activity number
ii. Description of activity
iii. Activity numbers for any predecessor and successor activities
iv. Relationships with preceding activities
v. Activity duration in calendar days
vi. Percent of activity completed
vii. Early start date (by Calendar Date)
viii. Early finish date (by Calendar Date)
ix. Actual start date (by Calendar Date)
x. Actual finish date (by Calendar Date)
xi. Float or slack (by Calendar Date)

(6) The Contractor's monthly progress schedules and any required recovery schedules shall show the activities or portion of the activities completed during the reporting period and their total dollar value as basis for the Contractor's periodic request for payment. For each activity, the update shall state the percentage of Work actually completed and the progress along the critical path in terms of Days ahead or behind the allowable dates.

(7) The Contractor's monthly progress schedules and any required recovery schedules shall include a comments section summarizing the updated analysis for the Contract Work as a whole, describing any and all problems with Work activities, and explaining proposed corrective actions.

(8) Approved Change Orders shall be reflected as new activities or as change in logic and/or time framing of existing activities. Approved Change Orders shall be shown on the Contractor's applicable updated schedule that immediately follows the Contractor's receipt of a Change Order approval from the County.

(9) The Contractor shall hold bi-weekly progress meetings, or more frequently if required by Engineer, at the Work site, at a time suitable to the Engineer, at which the progress of the Work shall be reported upon in detail with reference to all applicable schedules. Each interested Subcontractor shall be required to have present a competent representative to report the condition of the Subcontractor's portion of the Work and to receive instructions. Minutes of these progress meetings shall be taken by the Contractor who shall type them for distribution to members of the meeting, the Department's Division of Construction Contracts Administration, the Department's Bureau of Engineering and Construction, and other interested persons. These minutes shall be received by all parties prior to the next scheduled progress meeting and will be revised by the Contractor if not accurately describing events to date.

ANY AND ALL MINUTES FROM ANY PROGRESS MEETING ARE FOR INFORMATIONAL PURPOSES ONLY. THESE MINUTES ARE NOT INCORPORATED INTO THE CONTRACT DOCUMENTS AND ARE NOT LEGALLY BINDING UPON THE DEPARTMENT OR THE COUNTY.

(f) Form of Schedule Submittal.

All schedules including, but not limited to, the baseline schedule, the monthly progress schedules, and any required recovery schedules shall be submitted by the Contractor to the County in three (3) paper copies and one (1) copy on CD.

GP-8.05 LIMITATIONS OF OPERATION

The Contractor shall conduct the Work at all times in such a manner and in such sequence as will assure the least interference with the public.

Except as otherwise stated in the Contract Documents, no Work shall be done on Saturdays, Sundays, or Holidays without the prior written approval of the Engineer. Except for

emergencies, approval to Work on Saturdays, Sundays and Holidays shall be obtained forty-eight (48) hours in advance.

GP-8.06 CHARACTER OF WORKMEN, METHODS AND EQUIPMENT

(a) The Contractor shall employ sufficient labor and Equipment for prosecuting the several and all classes of Work to achieve Full and Final Completion in the manner and time required by the Contract.

Workmen must have sufficient skill and experience to properly perform the Work assigned to them. All workmen engaged in special Work or skilled Work shall have sufficient experience in such Work and in the operation of the Equipment required to perform the Work properly and satisfactorily.

(b) Any person employed by the Contractor or by any Subcontractor who, in the opinion of the Engineer, does not perform his Work in a proper manner or is intemperate or disorderly shall, at the written request of the Engineer, be removed forthwith by the Contractor or Subcontractor employing such person, and shall not be employed again in any portion of the Work without the prior written approval of the Engineer.

Should the Contractor fail to remove such person or persons as required in this GP-8.06(b), or fail to furnish suitable and sufficient personnel for the proper prosecution of the Work, the Engineer may withhold estimates and/or monies which are or may become due on the Contract until a satisfactory understanding and resolution is reached in the County's sole discretion.

(c) Only persons thoroughly trained and skilled in the task assigned them may be employed on any portion of the Work, or they shall be removed by the Contractor.

When County, State or federal laws require that certain persons (such as, by way of example, electricians, plumbers, etc.) be licensed, then all such persons employed on the Work shall be so licensed.

(d) The Contractor shall confine the operations of Contractor's employees and agents to the limits as provided by law, regulations, executive orders, ordinance, permits or directions of the Department. Generally, the "off-Road" area will be the same as the "limit of Contract" line.

(e) All workmanship shall be of good quality. Whenever the method or manner of the Work or manner of procedure is not specifically stated or shown in the Contract Documents, then it is intended and understood that the best standard practice shall be adhered to by the Contractor. Recommendations of the manufacturers of approved Materials shall be considered as a part of and incorporated into the Standard Specifications and all Materials shall be applied, installed, connected, erected, used, cleaned and conditioned as so called for thereby. This, however, does not remove any requirement in Contract to add to the manufacturer's recommendations.

All Materials shall be accurately assembled, set, etc., and when so required in good Construction, shall be true to line, even, square, plumb, level and regularly spaced, coursed, etc. Under no circumstances, either in new or old Work, shall any Material be applied over another which has not been thoroughly cleaned, sanded or otherwise treated so as not to impair the finish, adhesion, or efficiency of the next applied item.

(f) Equipment to be used on the Work shall meet the requirements of the Work and produce a satisfactory quality of Work in accordance with the Contract. The Engineer may order the removal and require replacement of any unsatisfactory Equipment at the Engineer's sole discretion. When the methods and Equipment to be used by the Contractor in accomplishing the Construction are not prescribed in the Contract, the Contractor is free to use any methods or Equipment that Contractor demonstrates in advance to the satisfaction and written approval of the Engineer will accomplish the Contract Work in conformity with the requirements of the Contract.

When the Contract specifies that the Construction be performed by the use of certain methods and Equipment, such methods and Equipment shall be used unless others are pre-authorized by the Engineer in writing. If the Contractor desires to use a method or type of Equipment other than those specified in the Contract, the Contractor shall request authority from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and Equipment proposed for use and an explanation of the reasons for Contractor desiring to make the change. If written pre-approval of the Engineer is given, it will be on the condition that the Contractor will be fully responsible for producing Construction Work in conformity with Contract requirements. If, after trial use of the substituted methods or Equipment, the Engineer determines that the Work produced does not meet Contract requirements, the Contractor shall promptly discontinue the use of the substituted method or Equipment and shall complete the remaining Construction with the specified methods and Equipment in accordance with the Contract. The Contractor shall remove the deficient Work and replace it with Work of specified quality, or take such other corrective action as the Engineer may direct. Any Change Order issued, if any, in accordance with this GP-8.06(f) shall not result in an increase in Contract price or Contract Time.

(g) All methods, procedures and results are subject to the Engineer's approval as to the finished result to be obtained. However, this is not to be interpreted as placing upon the Engineer any responsibility for the Work management that is solely the responsibility of the Contractor.

The Contractor shall at all times enforce strict discipline and good order among Contractor's employees and agents. The Contractor shall neither employ any unfit person nor shall the Contractor permit an unfit person to remain on the Work site. The Contractor shall enforce all instructions relative to use of water, heat, power, smoking, and shall control any use of fires, as required by law, regulation, and the Contract and by the Department. Employees and agents of the Contractor shall not loiter on, near or about the Work site before or after work.

GP-8.07 SUSPENSION OF WORK

(a) The Engineer may unilaterally order the Contractor in writing to suspend the Work, wholly or in part, for such period or periods as Engineer may deem necessary, in the Engineer's sole discretion, for reasons including, but not limited to, unsuitable weather or such other conditions as are considered unfavorable for the proper prosecution of the Work, or for such time as is necessary because the Contractor has failed to carry out orders given or to perform any and all provisions of the Contract. If it should become necessary to stop Work for an indefinite period, the Contractor shall store all Materials in such manner that they will not obstruct or impede the traveling public unnecessarily or become damaged in any way, and the Contractor shall take every precaution to prevent damage or deterioration of the Work performed, provide suitable drainage by opening ditches, Shoulder drains, etc., and erect temporary Structures where necessary.

(b) If the performance of all or any part of the Work is for an unreasonable period of time, suspended, delayed, or interrupted by an act of the Engineer in the administration of this Contract, or by Engineer's failure to act within the time specified in this Contract (or if no time is specified, within a reasonable time), an adjustment shall be made for any increase in the cost of performance of this Contract (excluding profit) necessarily caused by an unreasonable suspension, delay, or interruption and a Contract Modification executed accordingly. However, no adjustment shall be made under this GP-8.07 for any suspension, delay, or interruption of the Work to the extent that performance would have been so suspended, delayed or interrupted by any other cause, including, but not limited to, the fault or negligence of the Contractor, including, but not limited to, GP-8.07(a) and (c), or for which an equitable adjustment is provided for or excluded under any other provisions of this Contract.

(c) The Engineer shall have the unilateral authority to suspend the Work, wholly or in part, due to the failure of the Contractor to correct conditions unsafe for the workers or the general public; for Contractor's failure to carry out the requirements of the Contract Documents; or as directed in conformance with the Contract Documents for conditions considered unsuitable for the prosecution of the Work.

(d) No claim under this General Provision shall be allowed:

(1) For any costs incurred more than twenty (20) Days before the Contractor shall have notified the Engineer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension ordered by Engineer); and

(2) Unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of a suspension, delay, or interruption, but not later than the date of final payment under the Contract.

(e) If the Contractor should neglect to prosecute the Work properly or fail to perform any provision of this Contract, the County after three (3) Days' Written Notice to the Contractor may, without prejudice to any other remedy, make good such deficiencies and/or perform the Contract or any portion thereof, as deemed applicable and appropriate by the County in its sole

discretion, and may deduct the cost thereof from the payment then or thereafter due the Contractor.

GP-8.08 TERMINATION FOR DEFAULT - DAMAGES FOR DELAY - TIME EXTENSIONS.

(a) If the Contractor refuses or fails to timely and properly prosecute the Work, in whole or in part, with such diligence as shall insure Full and Final Completion within the Contract Time, or breaches the terms of the Contract, termination for default, in whole or in part, shall be evidenced and the Department may, by Written Notice to the Contractor, terminate the Contract and the Contractor's right to proceed with the Work, in whole or in part, in accordance with this GP-8.08.

(b) The Department, upon proof that sufficient cause exists to satisfy such action, in the County's discretion, may without prejudice to any other right or remedy, terminate the Contract for default, in whole or in part. Termination for default, in whole or in part shall be evidenced and documented by Written Notice by the County to the Contractor and said termination for default shall be effective seven (7) days after Contractor's receipt of such Written Notice. Upon a termination for default the County may take over the Work and take possession of the Work and of all Materials, tools, Equipment and plant thereon and prosecute the same to completion, by contract, by whatever method may be deemed expedient, or otherwise, and may take possession of and utilize in completing the Work, the Materials, Equipment, and plant as may be on the site of the Work and necessary therefore. Whether or not the Contractor's right to proceed with the Work is terminated for default, the Contractor and its Sureties shall be liable for any damage to the County resulting from the Contractor's refusal or failure to achieve Full and Final Completion of the Work within the Contract Time and/or the Contractor's breach of the Contract Documents.

The County may appropriate or use any or all Materials and Equipment intended to be incorporated in the Contract as may be suitable and acceptable and may enter into an agreement for the completion of said Contract according to the terms and provisions thereof, or use such other methods as in the County's determination shall be required for the completion of said Contract in a manner acceptable to the County.

(c) Examples of sufficient cause to terminate for default include, but are not limited to, cases where the Contractor should:

(1) Be adjudged a bankrupt or make a general assignment for the benefit of creditors,

(2) Have a receiver appointed on account of insolvency,

(3) Fail to or refuse to supply properly skilled persons or proper Materials, Equipment except in cases for which extension of time is provided by the County,

(4) Fail to make payment to a Subcontractor, materialmen, supplier, and/or other persons.

(5) Fail to comply with any law, regulation, executive order, ordinance, or persistently disregarded the instructions of the Engineer, or

(6) Breach any material representation, warranty, covenant, condition, obligation, or provision of the Contract.

(d) If the County terminates for default of the Contract under this GP-8.08, the Contractor shall not be entitled to receive any further payment until the Contract Work is finished and, even then, only if the unpaid balance of the Contract price shall exceed the expenses of finishing the Work, including compensation for additional managerial and administrative services, shall such excess be paid to the Contractor. If such expenses shall exceed such unpaid balance, the Contractor shall pay the difference to the County. The expenses incurred by the County as herein provided, and the damage incurred by the County as herein provided, and the damage incurred through the Contractor's default, shall be itemized by the Engineer and a certified copy supplied to the Contractor.

(e) The Contractor's right to proceed may not be terminated for default and the Contractor shall not be charged with resulting damages if:

(1) The delay in the completion of the Work arises solely from unforeseeable causes beyond the control and without the act, omission, fault or negligence of the Contractor including, but not restricted to, acts of God, acts of the public enemy, acts of the County in either its sovereign or contractual capacity, acts of another contractor in the performance of a contract with the County, fires, floods, epidemics, quarantine, restrictions, strikes, freight embargoes, unusually severe weather, or delays of Subcontractors or supplies arising solely from unforeseeable causes beyond the control and without the act, omission, fault or negligence of either the Contractor and/or the Subcontractors, suppliers or materialmen; and

(2) The Contractor, within ten (10) Days from the beginning of any such delay (unless the Engineer grants a further period of time before the date of final payment under the Contract), notifies the Engineer in writing of the causes of delay. The Engineer shall ascertain the facts and the extent of the delay and extend the Contract Time for completing the Work when, in the Engineer's judgment, the findings of fact justify such an extension, and the Engineer's findings of fact shall be final and conclusive on the parties, subject only to appeal as provided in the GP-5.15 "Disputes".

(f) If, after notice of termination for default of the Contract and the Contractor's right to proceed under these General Provisions, it is determined for any reason that the Contractor was not in default under the provisions of the Contract, or that the delay was excusable under the provisions of the Contract, the rights and obligations of the parties shall be the same as if the notice of termination had been issued pursuant to GP-8.10.

(g) The rights and remedies of the County provided in this GP 8.08 are in addition to any other rights and remedies provided by law, equity and/or under this Contract.

(h) As used in GP 8-08, the term Subcontractors, materialmen, or suppliers means Subcontractors, materialmen or suppliers at any tier.

GP-8.09 LIQUIDATED DAMAGES

TIME IS AN ESSENTIAL ELEMENT OF THE CONTRACT AND IT IS IMPORTANT THAT THE WORK BE VIGOROUSLY PROSECUTED UNTIL FULL AND FINAL COMPLETION OF THE CONTRACT.

FOR EACH DAY THAT FULL AND FINAL COMPLETION REMAINS UNACHIEVED BEYOND THE CONTRACT TIME, THE CONTRACTOR AND/OR ITS SURETY SHALL BE LIABLE FOR LIQUIDATED DAMAGES IN THE AMOUNT PROVIDED FOR IN THE CONTRACT.

(a) ALL ADDITIONAL COSTS AND CHARGES INCURRED BY THE COUNTY, INCLUDING, BUT NOT LIMITED TO, ANY AND ALL DAMAGE TO PERSONS OR PROPERTY, THE COST OF COMPLETING THE WORK UNDER THE CONTRACT, SHALL BE DEDUCTED FROM ANY MONIES DUE OR WHICH MAY BECOME DUE TO CONTRACTOR. IF THE EXPENSE SO INCURRED BY THE COUNTY IS LESS THAN THE SUM WHICH WOULD HAVE BEEN PAYABLE UNDER THE CONTRACT IF IT HAD BEEN COMPLETED BY SAID CONTRACTOR, THE SAID CONTRACTOR SHALL BE ENTITLED TO RECEIVE THE DIFFERENCE, AND IF SUCH EXPENSE EXCEEDS THE SUM WHICH WOULD HAVE BEEN PAYABLE UNDER THE CONTRACT, THE CONTRACTOR AND THE SURETY SHALL BE LIABLE AND SHALL PAY TO THE COUNTY THE AMOUNT OF SAID EXCESS.

(b) IF FIXED AND AGREED LIQUIDATED DAMAGES ARE PROVIDED IN THE CONTRACT AND IF THE COUNTY SO TERMINATES THE CONTRACT, AND ACCORDINGLY THE CONTRACTOR'S RIGHT TO PROCEED, THE RESULTING DAMAGE SHALL CONSIST OF SUCH LIQUIDATED DAMAGES FOR THE REASONABLE TIME REQUIRED FOR FULL AND FINAL COMPLETION OF THE WORK TOGETHER WITH ANY INCREASED COSTS AND EXPENSES INCURRED BY THE COUNTY IN COMPLETING THE WORK.

(c) IF FIXED AND AGREED LIQUIDATED DAMAGES ARE PROVIDED IN THE CONTRACT AND IF THE COUNTY DOES NOT SO TERMINATE THE CONTRACTOR'S RIGHT TO PROCEED, THE RESULTING DAMAGE SHALL CONSIST OF THESE LIQUIDATED DAMAGES UNTIL FULL AND FINAL COMPLETION IS ACHIEVED.

(d) Interest shall accrue upon all damages, liquidated or otherwise, at the statutory rate of interest provided pursuant to the Maryland Constitution and the Maryland Code, as applicable and as amended.

GP-8.10 TERMINATION FOR CONVENIENCE OF THE COUNTY

(a) The performance of Work under this Contract may be terminated for convenience by the County, in whole, or in part, whenever the Engineer shall determine that such termination for convenience is in the best interest of the County. Any such termination for convenience shall be effected by Engineer's delivery to the Contractor of a Written Notice of termination for convenience specifying the extent to which performance of Work under the Contract is terminated, and the date upon which such termination becomes effective.

(b) After receipt of notice of termination for convenience, and except as otherwise directed by the Engineer, the Contractor shall:

(1) Stop Work under the Contract on the date and to the extent specified in the Written Notice of termination for convenience;

(2) Place no further orders or Subcontracts for Materials, supplies, Equipment, services or facilities, except as may be necessary for completion of the portion of the Work under the Contract that is not terminated for convenience;

(3) Terminate all orders and Subcontracts to the extent that they relate to the performance of Work terminated by notice of termination for convenience;

(4) Assign to the County in the manner, at the times, and to the extent directed by the Engineer, all of the right, title, and interest of the Contractor under the orders and Subcontracts, in which case the County shall have the right, in its discretion, to settle or pay any or all claims arising out of such orders and Subcontracts, or assume said orders and subcontracts, or do otherwise, as deemed appropriate in the sole discretion of the County;

(5) Settle all outstanding liabilities and all claims arising out of the termination of orders and Subcontracts, with the approval or ratification of the Engineer, to the extent he may require, which approval or ratification shall be final for all the purposes of this GP-8.10;

(6) Transfer title and deliver to the County, in the manner, at the times and to the extent, if any, directed by the Engineer, (a) the fabricated or unfabricated parts, Work in process, completed Work, supplies, and other Material produced as a part of, or acquired in connection with the performance of the Work terminated for convenience by the Written Notice of termination for convenience, and (b) as applicable, the completed or partially completed Plans, Contract Drawings, As-Built Drawings, operation and maintenance manuals, warranty certificates, information, and other property which, if the Contract had been completed, would have been required to be furnished to the County;

(7) Use its best effort to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by the Engineer, any property of the types referred to in (6) above; provided, however, that the Contractor (a) may not be required to extend credit to any

purchaser, and (b) may acquire any such property under the conditions prescribed by and at a price or prices approved by the Engineer; and provided further that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the County to the Contractor under this Contract or shall otherwise be credited to the price or cost of the Work covered by this Contract or paid in such other manner as the Engineer may direct;

(8) Complete performance of such part of the Work as may not have been terminated by the Written Notice of termination for convenience; and

(9) Take any action that may be necessary, or as the Engineer may direct, for the protection and preservation of the property related to this Contract which is in the possession of the Contractor and in which the County has or may acquire an interest. The Contractor shall submit to the Engineer a list, with Certification as to quantity and quality, of any or all items of inventory not previously disposed of, exclusive of items the disposition of which has been directed or authorized by the Engineer, and may request the County to remove such items or enter into a storage agreement covering them. Not later than fifteen (15) Days thereafter, the County shall accept title to such items and remove them or enter into a storage agreement covering the same; provided, that the list submitted shall be subject to verification by the Engineer upon removal of the items, or if the items are stored, within forty-five (45) Days from the date of submission of the list, and any necessary adjustment to correct the list as submitted shall be made prior to final settlement.

(c) After receipt of a Written Notice of termination for convenience, the Contractor shall submit to the Engineer his termination for convenience claim, in the written form and with Certification prescribed by the Engineer. This claim shall be submitted promptly in accordance with GP-5.14 and GP-5.15 of these Standard Specifications, unless an extension is granted in writing by the Engineer, upon timely request of the Contractor in writing.

(d) Subject to this GP-8.10 (c), the Contractor and the Engineer may agree upon the whole or any part of the amount or amounts to be paid to the Contractor by reason of the total or partial termination for convenience of Work pursuant to this GP 8-10, which amount or amounts may include a reasonable allowance for profit on Work done; provided, that such agreed amount or amounts, exclusive of settlement costs, shall not exceed the total Contract price as reduced by the amount of payments otherwise made and as further reduced by the Contract price of Work not terminated for convenience. If the parties so agree, the Contract shall be amended with a Contract Modification, and the Contractor shall be paid the amount specified therein.

(e) In the event of the failure of the Contractor and the Engineer to agree as provided in GP-8.10 (d), upon any amount to be paid to the Contractor by reason of the termination for convenience of Work pursuant to this General Provision, the Engineer shall pay to the Contractor the amounts determined by the Engineer as follows, but without duplication of any amounts agreed upon in accordance with GP-8.10 (d):

(1) For completed supplies or services accepted by the County (or sold or acquired as provided in GP-8.10 (b)(7) above) and for which payment has not theretofore been made, a sum equivalent to the aggregate price for the supplies or services computed in accordance with the

price or prices specified in the Contract, appropriately adjusted for any saving of freight or other charges;

(2) The total of:

(a) The costs incurred in the performance of the Work terminated for convenience, including initial costs and preparatory expense allocable thereto, but exclusive of any costs attributable to supplies or services paid or to be paid for under GP-8.10 (e)(1) hereof; and

(b) The cost of settling and paying claims arising out of the termination of Work under Subcontracts or orders, as provided in GP-8.10 (b)(5) above, which are properly chargeable to the termination for convenience portion of the Contract (exclusive of amounts paid or payable on account of supplies or Materials delivered or services furnished by Subcontractors or vendors before the effective date of the Written Notice of termination for convenience, which amounts shall be included in the costs payable under GP-8.10 (e)(2)(a); and

(c) A sum, as profit on GP-8.10 (e)(2)(a), determined by the Engineer to be fair and reasonable; provided, however, that if it appears that the Contractor would have sustained a loss on the entire Contract had it been completed, no profit shall be included or allowed under this GP-8.10 (e)(2)(c) and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss; and

(d) The reasonable cost of settlement accounting, legal, clerical, and other expenses reasonably necessary for the preparation of settlement claims and supporting data with respect to the terminated portion of the Contract and for the termination and settlement of Subcontracts thereunder, together with reasonable storage, transportation, and other costs incurred in connection with the protection or disposition of property allocable to this Contract.

The total sum to be paid to the Contractor under this GP-8.10 (e) shall not exceed the total Contract price as reduced by the amount of payments otherwise made and as further reduced by any Contract price of Work not terminated for convenience. Except for normal spoilage, and except to the extent that the County shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor as provided in GP-8.10 (e), the fair value, as determined by the Engineer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the County or to a buyer pursuant to GP-8.10 (b)(7).

(f) The Contractor shall have the right of appeal, under GP-5.15 "Disputes", from any determination made by the Engineer under this GP-8.10, except that if the Contractor has failed to timely submit its claim within the time provided in this GP-8.10, and has failed to request extension of such time, Contractor shall have no such right of appeal. In any case where the Engineer has made a determination of the amount due under this GP-8.10, the County shall pay to the Contractor the following:

(1) If there is no right of appeal hereunder and/or if no timely appeal has been taken, the amount so determined by the Engineer; or,

(2) If an appeal has been taken, the amount finally determined on such appeal.

(g) In arriving at the amount due the Contractor under this GP-8.10 there shall be deducted:

(1) All unliquidated advance or other payments or account theretofore made to the Contractor, applicable to the terminated for convenience portion of this Contract;

(2) Any claim which the County may have against the Contractor in connection with this Contract; and

(3) The agreed price for, or the proceeds of sale of, any Materials, supplies, or other things acquired by the Contractor or sold, pursuant to the provisions of this GP-8.10, and not otherwise recovered by or credited to the County.

(h) If the termination for convenience hereunder be partial, the Contractor may file with the Engineer a written claim for an equitable adjustment in accordance with GP-5.14 and GP-5.15 of the price or prices specified in the Contract relating to the continued portion of the Contract (the portion not terminated by the Written Notice of termination for convenience), and such equitable adjustment as may be agreed upon shall be made in such price or prices in a Contract Modification.

(i) The County may, from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against costs incurred by the Contractor in connection with the terminated for convenience portion of this Contract whenever, in the opinion of the Engineer, the aggregate of such payments shall be within the amount to which the Contractor shall be entitled hereunder. If the total of such payments is in excess of the amount finally agreed or determined to be due under this General Provision 8.10, such excess shall be payable by the Contractor to the County upon demand, together with interest at the legal rate as prescribed by State law for the period from the date such excess payment is received by the Contractor to the date on which the excess is repaid to the County.

(j) Unless otherwise provided for in this Contract, or by applicable statute, the Contractor shall, from the effective date of termination for convenience until the expiration of three (3) years after final settlement under this Contract, preserve and make available to the County at all reasonable times at the office of the Contractor but without direct charge to the County, all Contractor's books, records, documents and other evidence bearing on the costs and expenses of the Contractor under this Contract and relating to the Work terminated for convenience hereunder, or, to the extent approved by the Engineer, photographs, microphotographs, or other authentic reproductions thereof. If the Contract involves the use of federal or State funds, Contractor shall retain records and documentation as required by GP-7.36.

GP-8.11 SUCCESSFUL TERMINATION OF CONTRACTOR'S RESPONSIBILITY

Full and Final Completion is the date upon which the County acknowledges in writing that the Contractor fully and finally completed all aspects of the Contract and the Contract Work, and met all terms, conditions and obligations of the Contract, as further described herein. Full and Final Completion of a Contract includes Final Acceptance for Maintenance of all Contract Work; the authorization of final payment by the County; the Contractor's and its Surety's compliance with all obligations under the Contract; the submission of all Plans, Contract Drawings, As-Built Drawings (as described below), operation and maintenance manuals, and warranty certificates; the completion of all punch list Work; and final payment by the County to the Contractor.

The Contractor shall, as the Work progresses, neatly record on a set of final signed and sealed As-Built Drawings the Work as actually constructed by the Contractor and reflecting all Working Drawings including, but not limited to, any changes and all revisions to the Work made during the course of the Contract wherever it differs from the Contract Documents. Upon Final Acceptance for Maintenance of the Work, the Contractor shall turn over the As-Built Drawings to the County. No Full and Final Completion of the Contract by the County may occur until these As-Built Drawings are submitted to and approved by the County.

GP-SECTION 9
PAYMENT

GP-9.01 SCOPE OF PAYMENT

(a) Payments to the Contractor will be made for the actual quantities of Contract Items performed in accordance with the Plans and Contract Documents and if, upon completion of the Construction and the Work, these actual quantities show either an increase or decrease from the quantities given in any Contract schedule, the Contract unit prices will still prevail, except as provided in GP-4.04 "Variations in Estimated Quantities", or in a Contract Modification.

(b) Except as may otherwise be provided herein, the Contractor shall accept the compensation as provided by the Engineer under this GP-Section 9:

(1) In full payment for furnishing all Materials, lab, tools, and Equipment and any incidentals necessary to the completed Work and for performing all Work contemplated and embraced under the Contract;

(2) For all loss or damage arising from the nature of the Work, or from the action of the elements, or from any other unforeseen difficulties which may be encountered during the prosecution of the Work until Full and Final Completion of the Contract;

(3) For all risks of every description connected with the prosecution of the Work; and

(4) For all expenses incurred in consequence of suspension of the Work, if any, as herein authorized by the County.

(c) Where provisions in the Contract Documents relating to any unit price for a Contract Item require that the said unit price cover, and be considered, compensation for certain Work or Material essential to that Contract Item, this same Work or Material shall not also be measured or paid for under any other Contract Item which may appear elsewhere in the Contract Documents.

(d) The payment of any partial estimate or of any retained percentage by the County, in no way shall affect the obligation of the Contractor to Repair or renew any defective parts of the Construction and/or Work or to be responsible for all damages due to such defects.

(e) Payment to the Contractor under this section for Materials on hand in no way will be construed as acceptance by the Administration of title to the Material. Title shall remain with the Contractor until Final Acceptance for Maintenance of the Contract Work in accordance with GP-5.13.

The Contractor shall indicate its federal tax identification or social security number on the face of each invoice billed to the County.

(f) If the Contract is in excess of twenty-five thousand dollars ($25,000), the Contractor and any Subcontractor with a lower tier Subcontract, in accepting each Contract payment from the County is making a Certification and representing and warranting to the County, prior to receiving a progress or final payment under this Contract, that the Contractor or Subcontractor has made payment from proceeds of prior payments, and that the Contractor or Subcontractor will make timely payments, from the proceeds of the progress or final payment then due it, to its Subcontractors, materialmen, and suppliers in accordance with Contractor or Subcontractor contractual arrangements with them and pursuant to State Finance and Procurement Article of the Maryland Annotated Code, as amended. This Certification may be required by the Engineer even if the Contract is for twenty-five thousand dollars ($25,000) or less.

If the Contract is in excess of twenty-five thousand dollars ($25,000), the Contractor further represents and warrants that it shall also obtain from each Subcontractor a Certification that payment from proceeds of prior payments have been made to any lower tier Subcontractors and that timely payments will be made to the lower tier Subcontractors and suppliers in conformance with contractual arrangements with those lower tier Persons. This Certification is not required from Subcontractors who have no lower tier Subcontracts. These Certifications may be required by the Engineer for contract of twenty-five thousand dollars ($25,000) or less.

(g) For all Contract Items of Work, other than those to be paid by lump sum, after Final Acceptance for Maintenance of the Work and before final payment is made, the Engineer will make final measurements to determine the quantities of various Contract Items of Work performed as the basis for final settlement. The Contractor in case of unit price Contract Items will be paid for the actual amount of Work performed and for the actual amount of Materials in place, in conformance with the Contract Documents as shown by the final measurements made by the Engineer. All Work completed under the Contract will be measured by the Engineer in conformance with the standards of weights and measures recognized by the NBS and NIST.

The term lump sum when used as a Contact Item will mean complete payment for the unit of Work described and will be construed to include all necessary fittings and accessories for that Contract Item of Work.

(1) All longitudinal measurements for area will be made along the actual surface and not horizontally, and no deductions will be made for individual fixtures in the pavement having an area of nine (9) square feet or less. For all transverse measurements for area of Base Course and pavements, the dimensions to be used in calculating the pay area will be the neat dimensions shown on the Plans or as ordered in writing by the Engineer.

(2) Structure measurements will conform to the neat lines shown on the Plans or as ordered in writing by the Engineer, unless otherwise provided for elsewhere in the Contract Documents.

(3) Volumes of excavation, tamped fill and borrow pits will be calculated per cubic yard from the cross section and the use of average end area formulas. Volumes of other Work including, but not limited to, masonry and removal of masonry will be calculated by using arithmetical formulas. Where the volume is bounded by varying dimensions and there are no simple volumetric formulas applicable, frequent cross sections will be taken and the cubic yard volume computed from average end area formulas.

(4) Cement will be measured by weight.

(5) All items which are measured by the linear foot, including, but not limited to, pipe culverts, traffic barriers, underdrains, will be measured parallel to the base or foundation upon which such Structures are placed unless otherwise specified in the Contract Documents.

(6) The term gauge when used in connection with the measurement of uncoated steel sheet and light plates shall mean the USSG, except that when reference is made to the measurements of galvanized or aluminum sheets used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing, the term gauge shall mean that specified in M 36, M 167, M 196 or M 197.

(7) When the term gauge refers to the measurement of wire, it shall mean the Washburn & Moen wire gauge as referenced in the New Departure Handbook. A tolerance of plus or minus 0.003 inch shall apply.

(8) The term ton shall mean the short ton consisting of two thousand (2,000) pounds avoirdupois. All Materials which are specified for measurement by the ton shall be weighed on accurate, approved scales conforming to the requirements of the NBS Handbook 44. A digital recorder and printout shall be required on all truck scales. The digital recorder shall produce a printed record of the gross, tare, net weights, the time, date, truck identification and Contract Number. Provisions shall be made so that the scales may not be manually manipulated during the printing process. The system shall be interlocked to allow printing only when the scale has come to rest.

(9) Except for computer operated scales, all weights shall be certified by a bonded weigh Person supplied by the Contractor, producer or supplier. The security bond shall be one hundred thousand dollars ($100,000.00).

(10) If the Material is shipped by rail, the car weight may be accepted but the payment will be limited to the actual weight of Material. Car weights will not be acceptable for Material to be passed through mixing plants.

(11) All Materials for which measurements are obtained by the cubic yard shall be hauled in approved vehicles and measured at the point of delivery. No allowance will be made for the settlement of Material in transit. Approved vehicles for this purpose shall be of any size or type acceptable to the Engineer, provided that the body is of such shape that the actual contents may be readily and accurately determined. Unless all approved vehicles are of uniform capacity, each approved vehicle must bear a plainly legible identification mark indicating the specific approved capacity. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.

(12) When requested by the Contractor and approved by the Engineer in writing, Material specified to be measured by the cubic yard may be weighed, and such weights will be converted to cubic yards for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by a qualified laboratory and shall be agreed to by the Contractor before such method of measurement of pay quantities will be approved by the Engineer.

(13) Liquid asphalt Material delivered for the project will be measured by volume in each railroad tank car, tank truck, distributor tank or drums in which it is delivered. The measurements will be taken when the asphalt Material is of a uniform temperature and free from air bubbles, and the temperature of the Material will be recorded at that time by the Contractor.

The volumetric measurement of the asphalt material will be based upon a temperature of sixty degrees Fahrenheit (60° F). Only the quantity of asphalt Material actually placed in the Work and accepted will be considered in determining the amount due the Contractor.

Reference is hereby made to D 1250, Petroleum Measurement Tables.

(14) Timber will be measured by the thousand feet board measure (MBM) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.

(15) Rental of Equipment will be measured in hours of actual Work time by the Contractor, moving-in and moving-out costs, if any, and necessary traveling time of the Equipment within the limits of the Contract, except when special conditions make some other method of measurement desirable as determined by the Engineer.

(h) Payment will not be allowed for stored Materials except in specific instances approved in writing by the Engineer involving specially manufactured Contract Items or Contract Items

requiring a long lead time for delivery and as further described in GP-9.01(i), (j) and (k). No payment for stored Material will be made if it is anticipated that the Material will be incorporated into the Work within thirty (30) Days of the delivery of said Material to the Contractor or Work site.

(i) When the Contractor requests payment allowance for stored Materials and the Engineer gives written approval of those Materials stored, the following terms and conditions shall apply:

(1) For Superstructure members delivered and stored on the Work site, an allowance of one hundred percent (100%) of the Material cost plus freight charges as invoiced may be made provided the cost does not exceed ninety percent (90%) of the Contract price of the applicable Contract Item. The allowance will be based upon validated invoices or bills for Material including freight charges, and a copy thereof shall be made a part of the documented records for the Contract.

(2) For reinforcement steel, piling, pipe, traffic barrier, signs and sign assemblies, and other nonperishable Material in storage on the Contract, but excluding aggregates, cement, seed, plants, fertilizer or other perishable Contract Items, an allowance of one hundred percent (100%) of the invoiced cost of the Material plus freight charges to the Contractor may be made provided the cost does not exceed ninety percent (90%) of the Contract price of the applicable Contract Item. Such Material shall be delivered and stockpiled at the Contract Work site, and shall be tested by the Administration and found to conform with the Contract Documents or have been accepted under a County-approved Certification program prior to the allowance.

(3) No payment allowance will be made for fuels, form lumber, falsework, temporary Structures or other Materials of any kind which will not become an integral part of the finished Work.

(4) Only end product manufactured Material or fully fabricated products that are awaiting installation or incorporation into the finished Work are eligible for prepayment. Components, elements, or ingredients of a finished product are not eligible for prepayment or payment allowance.

(5) Stored Material for which a payment allowance is requested shall be stored in an approved manner in areas within the County where damage is not likely to occur. If any of the stored Materials are lost or become damaged in any manner, the Contractor shall be responsible for Repairing or replacing the damaged Materials. The value of the lost or damaged Material will be deducted from the Contractor's subsequent estimates until replacement has been accomplished. The request for payments allowances for any Materials stored on private property within the County shall be accompanied by a release from the applicable owner and/or tenant of such property agreeing to permit the removal of the Materials from the property without cost to the County.

When it is considered impractical to store Materials on the Work site, the Engineer may approve storage areas in the vicinity of the Work site which will be considered as the Work site for purposes of those stored Materials.

When storage of the Materials within the County is not practical, written approval shall be obtained from the Engineer for storage elsewhere. Storage of Materials outside the County will be subject to the conditions set forth in this GP-9.01 and limited to Materials exceeding twenty-five thousand dollars ($25,000), which are designed and fabricated exclusively for use on the Contract.

(6) Stored Material for which payment has been made, either wholly or partially by the County, shall not be removed from the approved location or Work site until such time that it is to be incorporated into the Work, unless authorized by the Engineer in writing.

(j) The following items shall accompany any written request by the Contractor for payment allowance for stored Materials:

(1) Consent of the Contractor's Surety specifying the Material type and the Contract Item(s) in which the Material is to be used.

(2) Validated invoices with the signature of an officer of the company supplying the Material showing actual cost.

(3) A notarized statement from the Contractor attesting that the invoices as submitted from the supplier do not include charges or fees for placing, handling, erecting or any other charges or markups other than the actual Material cost, sales tax(es), if applicable, and freight charges.

(4) Bills of lading showing delivery of the Material.

(5) The request for allowances for any Materials stored on property outside the County shall be accompanied by a release from the owner or tenant of such property agreeing to permit verification by the Department's Division of Construction Contracts Administration that the Material is stored at the approved location, and to permit the removal of the Materials from the property without cost to the County.

(6) Inspection test reports, Certifications and/or a written statement from the Department's Division of Construction Contracts Administration attesting to the inspection and approval of the Material.

Upon receipt of the above by the Engineer and verification by the Department's Division of Construction Contracts Administration that the Material is stored at the approved location, the Engineer will authorize payment.

The Contractor shall pay the Material supplier the amount shown on the invoice within seven (7) Calendar Days of receipt of payment from the Administration. Failure to make invoice payments as specified will be cause for the County to deduct the monies from future estimates to the Contractor.

Copies of all pertinent data relating to any stored Materials shall be made by the Contractor and distributed to the Department's Division of Construction Contracts Administration for retention as part of the documented records for the Contract.

(k) The Engineer may withhold, or on account of subsequently discovered evidence, nullify the whole or a part of any payment for stored Materials to such extent as may be necessary to protect the County from loss on account of:

(1) Defective Work not remedied.

(2) Claims filed, or reasonable evidence indicating probable filing of claims, by parties other than the Contractor.

(3) Failure of the Contractor to make payments properly to Subcontractors or for material or labor.

(4) A reasonable doubt that Full and Final Completion of the Contract can be achieved for the balance then unpaid.

(5) Damage to another contractor.

(6) Failure of the Contractor to submit data required within the time limits stated in the Contract Documents.

Upon removal of the Engineer's hold and resolution of all related issues, payment shall be made for any amounts withheld.

GP-9.02 FORCE ACCOUNT WORK

When the Contractor is required to perform Extra Work as a result of a Change Order or Contract Modification to the Contract for which there are no applicable unit prices in the Contract, the Engineer and the Contractor shall make every effort to come to an agreed price for the performance of such Extra Work. If an agreement cannot be reached by the parties prior to the time that Extra Work must commence, the Engineer may, in writing, order the Extra Work done on a force account basis by the Contractor, to be compensated in accordance with the following:

(a) **Labor.** For all labor and for foremen in direct charge of the specific operations of the Work, the Contractor shall receive the rate of wage agreed upon in writing by the County and the Contractor in either the Contract or a Contract Modification before the Contractor begins such Extra Work for each and every hour that said labor and foremen are actually engaged in such Extra Work, to which cost shall be added an amount equal to the percentage of the sum shown below. No additional allowance will be considered for Contract Bond, insurance, taxes or other fringe benefits; except as permitted in the County's discretion in a Written Notice or a Contract Modification. The number of laborers and foremen engaged in the Extra Work will be subject to

regulation by the Engineer and shall not exceed the number the Engineer deems most practical and economical for the Extra Work. The Contractor shall submit certified payrolls in conformance with the Contract Documents and pursuant to GP-9.02(g) signed by a legally authorized officer of the Contractor. Superintendent's time will not be allowed.

Highway Contracts 65%
Utility Contracts.....75%
Building Contracts 65%

(b) **Materials.** For Materials accepted by the Engineer and used for the Extra Work, the Contractor shall receive the actual cost of such Materials delivered to the Work site. This cost includes transportation charges paid by Contractor (exclusive of machinery rentals as specified in GP-9.02(d)), to which cost shall be added an amount equal to twenty percent (20%) plus prevailing State sales tax.

To substantiate Materials and transportation cost, original receipted invoices shall be submitted to the County by the Contractor, as further specified in GP-9.02(g).

If the Materials used in the force account Extra Work are not specifically purchased for the Extra Work but are taken from the Contractor's stock, then in lieu of the original invoices, the statements shall contain or be accompanied by an affidavit and Certification from the Contractor that shall certify that the Materials were taken from the Contractor's stock, that the quantity claimed was actually used, and that the price and transportation cost of the Material as claimed represents the actual cost.

The Administration reserves the right to furnish Materials as it deems appropriate, and the Contractor shall have no claim for any costs, overhead, or profit on these Materials.

(c) **Subcontractor's Works.**

(1) When a Contract Item of Extra Work is performed on a force account basis by a Subcontractor who is approved for this Extra Work by the Engineer, as may be required under GP-8.01, an amount equal to ten percent (10%) of the total cost shall be added to the final payment under GP-9.04 for such force account Extra Work and such amount of compensation shall be full and final compensation to the Contractor for the administration of the Extra Work performed by the Subcontractor under the force account basis.

(2) This additional ten percent (10%) compensation to the Contractor for administration shall only be allowed if the Extra Work requires particular trades or specialty work for which the Contractor is not prequalified, and not for Extra Work assigned to a Subcontractor for the convenience of the Contractor.

(d) **Equipment.** For any machinery or special Equipment approved by the Engineer for use on Extra Work (expressly excepting all small tools), including fuel and lubricants, the Contractor shall receive the rental rates and operating costs agreed upon in writing by the County and the Contractor in either the Contract or a Contract Modification before such Extra Work is begun by the Contractor for the actual time such Equipment is authorized on the Extra Work.

(1) Rental rate shall be based on the weekly rate converted into hours. To compute hourly rate use forty (40) hours per week.

(2) The rental rates and operating costs, including fuel and lubricant but excluding operators, for Extra Work shall be the current rates from the "Rental Rate Blue Book for Construction Equipment," published by the Equipment Guide Book Company and/or the "Rental Rate Blue Book for Older Construction Equipment." Both rental rate and operating rate will be subject to area adjustment per the "Rental Rate Blue Book for Construction Equipment." No other allowances or additions will be paid to the Contractor by the County.

(3) In the Engineer's discretion, rental rates will be applied to both idle time and actual operating time authorized by the Engineer, and operating rates will be applied to operating time only. Or, if the Engineer determines it to be in the County's best interest, standby rates shall apply when a piece of Equipment is required to remain on the Work site on standby status as authorized by the Engineer. For purposes of standby rates, when a unit of Equipment works for a portion of a day and is on standby for a portion, the total time allowed for rental rates shall not exceed eight (8) hours for that day and will be allowed for Working Days only. Standby rates shall be half of the normal hourly base rental rates without the operating expenses.

(4) Transportation costs of the Equipment directly attributable to force account Extra Work will be allowed. When it is necessary to obtain Equipment exclusively for force account Extra Work from sources beyond the Contract limits, the cost of transferring the Equipment to the Work site and return, including the use of any hauling unit, will only be allowed as an additional expense if the Contractor receives prior written approval from the Engineer.

(e) **Superintendence/Use of Small Tools.** No additional allowance shall be made for general superintendence, the use of small tools, or other costs for which no specific allowance is herein provided. For the purpose of definition under this GP-9.02, Equipment with a new cost of one thousand dollars ($1,000) or less will be considered small tools.

(f) **Compensation.** The compensation provided for in this GP-9.02 shall be received by the Contractor as full and final payment, including, but not limited to, overhead and profit, for Extra Work, Change Order Work, and/or Contract Modification Work done on a force account basis. The Contractor may request partial payment for force account Extra Work prior to submitting final documentation under GP-9.02(g). Partial payment will be limited to fifty percent (50%) of the amount for the Extra Work fully and finally accomplished until all documentation has been received and approved by the County. The final force account payment request from the Contractor for any Extra Work will be subject to audit as specified in GP-7.36 "Retention of Records".

At the end of each applicable Day, the Contractor and the Engineer shall compare records of the cost of all Extra Work as ordered on a force account basis and mutually agree on a final record of the costs of Extra Work for that Day. This record must be signed by both the Engineer and the Contractor on a daily basis. Daily force account records for Extra Work performed and signed by a Subcontractor, must also be signed by the Contractor and the Engineer. Each party shall

retain a copy of these records as substantiation of all labor, Equipment, and Materials used by the Contractor and any of its Subcontractors in the performance of the force account Extra Work.

(g) **Statements.** No payment will be made by the County for Extra Work performed on a force account basis until the Contractor furnishes the Engineer with duplicate itemized statements of the cost of such force account Extra Work detailed as to the following:

(1) Name, classification, date, daily hours, total hours, rate, and extension for such laborer, or foreman.

(2) Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and Equipment.

(3) Quantities of Materials, prices and extensions.

(4) Transportation of Materials.

(5) Payments of items under this GP-9.02(g)(1) shall be accomplished by copies of certified payrolls. Under this GP-9.02(g)(2), original receipted invoices for rentals must be provided. GP-9.02(g)(3) and GP-9.02(g)(4) shall be accompanied by original receipted invoices for Materials used and related transportation charges. Any request for payment for force account Extra Work shall be submitted by the Contract in strict compliance with this Section GP-9.02.

GP-9.03 PROGRESS PAYMENTS

(a) **Current Estimates.**

(1) **Lump Sum Contracts.** If requested by the Administration, the Contractor shall furnish an acceptable breakdown of the lump sum Contract price showing the amount included therein for each Pay Item of the Work. Said breakdown shall be in such detail so as to provide a basis for estimating monthly progress payments in connection with the Contract.

(2) **Monthly Estimates.** Except as otherwise stated in the Contract, each month the Administration will pay the Contractor for the Contract Work satisfactorily performed during the preceding calendar month, including Extra Work less five percent (5%). The five percent (5%) of the total Contract value retained by the Administration will not be released until final payment pursuant to GP-9.04 (unless partially released in a semi-final payment in the County's sole discretion). Current estimates will be based upon the Engineer's estimate of quantity (including Materials and/or Equipment complete in place) satisfactorily performed. In the instance of lump sum Contract Items, the Engineer's estimate shall be the proper fraction of the lump sum Contract Items satisfactorily performed during the preceding month. All quantities, estimates and fractions will be reasonably accurate approximations and are subject to correction (a) in subsequent current estimates, (b) in any semi-final estimate and, (c) in final payment. Any and/or all partial payments or monthly payments may be withheld in the event current requirements of the Contract Documents have not been complied with by the Contractor. Should

either the Engineer or the Contractor be of the opinion that any estimates, quantities and/or fractions (either as to an individual current estimate or accumulations thereof) do not represent a reasonably accurate approximation of actual Work satisfactorily performed, then details questioned shall be reviewed by the Engineer and then any corrections adjusted by the Engineer for in the next current estimate.

Deferred Monthly Payment. Should the amount(s) due the Contractor for any one month be less than five hundred dollars ($500.00), payment will be deferred until such time as the amount(s) due the Contractor under subsequent estimates, combined with that month for which the amount(s) due was less than five hundred dollars ($500.00), shall equal five hundred dollars ($500.00) or more.

(b) **Semi-Final Estimate Payments and Partial Semi-Final Estimate Payments.**

(1) **Semi-Final Estimate Payments.** Upon Final Acceptance for Maintenance by the Administration of the Contract Work, pursuant to GP-5.13(b), the Administration, at the Contractor's request and with consent of the Contractor's Surety, will pay the Contractor, within forty-five (45) Calendar Days of said request, what is hereby known as a semi-final estimate payment. Such a semi-final estimate payment will be based upon (a) quantities the Administration has computed and set up as proposed final quantities and (b) a reasonably accurate estimate for those quantities for which the Administration has not yet completed computations. The quantities which the Administration sets forth as proposed final quantities shall be so designated. To arrive at the amount of semi-final estimate payment there shall be deducted from the apparent estimated value of the Contract (a) total of all amounts previously paid to the Contractor as current estimates and (b) sums deemed chargeable against the Contractor properly deductible, including liquidated damages, and as a retainage, an amount equal to two percent (2%) of the total Contract value or two thousand dollars ($2,000), whichever is greater.

(2) **Partial Semi-Final Estimate Payments.** In cases where there has been Partial Acceptance for Maintenance for a majority of the Contract Work as determined in the County's sole discretion and there are remaining only inconsequential or minor Contract Items such as painting, seeding, mulching, or planting to be completed and such Contract Items cannot be completed for an extended period of time because of seasonal or weather conditions, the Administration, within forty-five (45) Days from the most recent Partial Acceptance for Maintenance, upon request of the Contractor and with consent of Surety, shall pay to the Contractor, what is hereby known as a partial semi-final estimate payment. Such a partial semi-final estimate payment will be based upon (a) quantities the Administration has computed and set up as proposed final quantities and (b) a reasonably accurate estimate for those quantities for which the Administration has not yet completed computations. The quantities which the Administration sets forth as proposed final quantities shall be so designated. To arrive at the amount of the partial semi-final estimate payment, there shall be deducted from the apparent estimated value of the Contract (a) total of all amounts previously paid to the Contractor as current estimates, and (b) sums deemed chargeable against the Contractor properly deductible, including liquidated damages, and as a retainage, a sum equal to two percent (2%) of the total value of the Contractor or two thousand dollars ($2,000), whichever is greater.

GP-9.04 FINAL ACCEPTANCE AND FINAL PAYMENT

(a) When the Contractor believes it has completed a Contract, and there has been a Final Acceptance for Maintenance in accordance with the provisions of GP-5.13(b), the Engineer will promptly proceed:

(1) To make any necessary final surveys;

(2) To complete any necessary computation of quantities; and

(3) To submit to the Contractor, within sixty (60) Calendar Days after Final Acceptance for Maintenance of the Work by the Engineer, for the Contractor's consideration, a written tabulation of the proposed final quantities. This written tabulation shall be accompanied by a written statement setting forth, as applicable: (a) the Additional Work performed under Change Orders and/or Contract Modifications; (b) the County-authorized extension of Contract Time; (c) the number of Days which have been charged against the Contractor as having been used to complete the Contract; and/or (d) any deductions, charges or liquidated damages which have been made or imposed against the Contractor by the County.

(b) The Contractor shall then have a period of twenty (20) Calendar Days, dating from the date upon which it received the written tabulation from the Engineer under Section GP-9.04(a), in which:

(1) To decide whether or not the Contractor will accept final payment based upon the Engineer's written tabulation; and

(2) To notify the Engineer, in writing, of the Contractor's decision. The Contractor may request an additional period up to ten (10) Calendar Days in which to notify the Engineer of its decision. In the event the Contractor notifies the Engineer that it protests final payment based on the Engineer's written tabulation, that notification shall outline the reason(s) for said protest.

(c) Upon receipt of a notification of acceptance as provided for in GP-9.04(b)(1) above (or in the event of no response), the County shall prepare the final estimate and final payment forms and submit the final payment check to the Contractor. Such action by the County shall be deemed to constitute final payment for all Work under the Contract.

(d) If, under the provisions of GP-9.04(b)(2) above, the Contractor notifies the Engineer of its protest and nonacceptance of the Engineer's written tabulation, the Engineer shall pay the Contractor a semi-final estimate, or an additional semi-final estimate in the event a semi-final estimate has already been paid, based upon the Engineer's written tabulation, with deductions for all prior payments. A retainage equal to one and one-half percent (1.5%) of the total value of the Contract shall be withheld by the Engineer. The acceptance of such semi-final estimate, or additional semi-final estimate, shall not be considered as a waiver on the part of the Contractor of its right to pursue its protest and press for Full and Final Completion and final payment.

(e) In the event the Contractor does not accept the Engineer's tabulation from GP-9.04(a) above and/or has outstanding a claim filed in accordance with GP-5.14, the Engineer and the Contractor shall confer at mutually convenient times and endeavor to reconcile all points of disagreement expeditiously. If such reconciliation is accomplished, the Engineer will promptly proceed with final payment on the reconciled basis and in accordance with the provisions of GP-9.04(c) above. If reconciliation is not accomplished within thirty (30) Days, the decision of the Engineer shall be submitted to the Director with a copy to the County Office of Law, Attention: County Attorney, as a dispute in accordance with GP-5.15 "Disputes". The Contractor's failure to timely comply with the provisions of GP-5.15 shall constitute a waiver by the Contractor of its right under GP-5.15, and final payment may be made by the County based on the Engineer's recommendation.

(f) All prior partial estimates and payments shall be subject to correction by the Engineer at the time of final payment and if the Contractor has been previously overpaid, as determined by the Engineer, the amount of such overpayment shall be set forth in the final payment forms and the Contractor hereby agrees that it will reimburse the Administration for such overpayment within six (6) months of receipt of such notice by the Engineer, and the Contractor's Surety will not be granted release from obligations under the terms of the Contract until reimbursement has been made in full by the Contractor. It is further agreed that the County can withhold any overpayment from any other accounts due and payable to the Contractor under any County contract.

(g) Payment for the full apparent value of the Contract thus determined shall become due and payable to the Contractor within ninety (90) Days after Full and Final Completion of the Contract, as provided in GP-8.11. Contractor's acceptance of final payment shall be considered a general release of any, all, and every claim and/or dispute against the County arising out of, or in any way connected with, this Contract and the Work.

(h) Neither Full and Final Completion nor final payment nor any provision in the Contract shall relieve the Contractor of responsibility for faulty Materials and workmanship. Unless otherwise specified, the Contractor shall remedy any defects and pay for any damage to other Work resulting therefrom that appears within the applicable warranty period. The County shall give notice of observed defects to the Contractor with reasonable promptness.

GP-9.05 LATE PAYMENTS – Reserved.

GP-9.06 INTEREST

Notwithstanding any other provision in the Contract, the Contractor hereby waives the right to predecisional interest. For purposes of this GP-9.06 and the Contract, "predecisional" means a decision by any Engineer or the County Administrative Officer, or his designee, or a decision by any Person including but not limited to an administrative hearing officer. The Contractor shall only be entitled to postdecisional interest, and for purposes of this GP-9.06 and the Contract,

"postdecisional" interest shall only begin to accrue, after the exhaustion of all administrative remedies and the rendering of a judgment by a court of competent jurisdiction.

GP-SECTION 10
PRIVATE CONTRACTS

GP-10.01 PRIVATE CONTRACTS

(a) A Private Contract is used in land development projects when, with the permission of the Director of the County Department of Permits, Approvals and Inspections, the Construction Contract is let by a developer and processed through the County. The applicable developer shall obtain the Bid privately and the cost estimates will be processed using County contract forms provided by the Department's Division of Construction Contracts Administration or as approved by County for use with a UA and/or RA. No public funds may be used in a Private Contract. UA and RA are not governed by those provisions of these Standard Specifications which involve payment by developers to contractors.

(b) The following sections, as amended by the County, apply to Private Contracts:

107.03.02 (4)
204.03.07 B
1001.03.01(b)(2)
501.03.14
501.04.05
504.03.03 B
504.04

For Private Contracts, all references to the County (including Administration) in this GP-10.01 shall be construed to mean the developer as defined in the governing UA and/or RA in the Standard Specifications and in all references to making payments under the contract.

(c) IN ALL OTHER PORTIONS OF THESE STANDARD SPECIFICATIONS, REFERENCES TO THE COUNTY SHALL REMAIN UNCHANGED, WHETHER THE CONTRACT IS PUBLIC OR PRIVATE.

(d) Private Contracts may include fixed price Contingent Items to provide for certain contingencies encountered during Highway and utility Construction. If included in the Bid, unit prices shall be those established by the County.

(1) Fixed Price Highway Contingent Items - Private Contract Only
See Section 109 of Category 100 "Preliminary".

(2) Fixed Price Utility Contingent Items - Private Contract Only
See Section 109 of Category 100 "Preliminary".

(3) Award and Execution of Contract - Private Contract Only [GP-3.03 Performance Bond and Payment Bond Requirements].

In GP-3.03(b) delete the words "twenty-five thousand dollars ($25,000)" and substitute "two thousand dollars ($2,000)".

(4) Unauthorized Work - Private Contracts Only [GP-4.08 Unauthorized Work].

Add the following new paragraph:

Any Work performed in excess of one hundred ten (110%) percent of the Private Contract Bid, or one hundred ten (110%) percent of the Private Contract Bid plus any Contract Modifications, between the developer and the Contractor, shall be considered unauthorized Work and shall not be paid for. The Contractor is advised to bring to the attention of the developer and the County, in writing, any impending overrun of the one hundred ten (110%) percent upset limitation at least two (2) weeks before having to stop work due to this limitation.

(5) Interest - Private Contracts Only [GP-9.06 Interest].

Payment by the developer under GP-9.03(b)(1) "Semi- Final Estimate Payments" and GP-9.04 "Final Acceptance and Final Payment", shall be due on receipt of the monthly estimates, semi-final estimates, and final estimates prepared by the Department and submitted to both parties in the amount shown as payable on this estimate. Any monies not paid within fifteen (15) Days of the date of such estimates shall bear interest at the rate of eighteen percent (18%) per annum. Interest shall be computed and invoiced by the Contractor and shall not be subject to a review or approval by the Department. However, the Department will not consider the developer's Public Works Agreement obligations complete as long as the Contractor reports an outstanding indebtedness under the Private Contract.

(6) Interim Acceptance - Development Bonds - Private Contract Only GP-9.03(b).

Add the following new paragraph:

When the Contractor postpones Road surfacing (during the course of completing a two-phased, 4-inch, paving section) its retainage shall be 2.0 percent after the bituminous Base Course has been accepted. Following a satisfactory re-inspection one (1) year after that acceptance, the retainage may be reduced to 0.0 percent.

GP 10.02 UTILITY/ROAD AGREEMENTS

These UA and/or RA are for projects wherein the applicant (developer, Persons, or property owners) constructs and installs improvements to utilities or Roads all at no cost to the County. The County Department of Permits, Approvals and Inspections (PAI), or any successor County department, in accordance with the applicable provisions of the County Code, as amended from

time to time, and the PAI Construction Policy Manual, approves the cost estimates and Construction Drawings and collects, except for County departments and agencies, the security and all fees. An applicant must provide to PAI, in writing, the name, address and phone number of an authorized Work site representative. The applicant must use a County prequalified Contractor who provides a certificate of insurance and performs the work in accordance with the Department's Standard Specifications and Standard Details in effect on the date of the Notice to Proceed. It is the applicant's responsibility to schedule an on-site pre-Construction meeting with the Department, the Department of Environmental Protection and Sustainability, or any successor County department, and the County prequalified Contractor. No Construction is to be performed prior to receiving a written Notice to Proceed from the Department.

TC - SECTION 1
REFERENCES AND DEFINITIONS

TC-1.03 METRIC SYSTEM – Reserved.

TC-1.04 LANGUAGE – Reserved.

TC - SECTION 2
BIDDING REQUIREMENTS AND CONDITIONS

TC-2.01 PROJECT CLASSIFICATION.

The Administration will estimate the cost of the Contract and classify it within one cost group and letter designation as follows:

COST GROUP ESTIMATE	COST GROUP LETTER CLASS
Up to $ 100 000	A
$ 100 001 to $ 500 000	B
$ 500 001 to $ 1 000000	C
$ 1 000 001 to $ 2 500 000	D
$ 2 500 001 to $ 5 000 000	E
$ 5 000 001 to $ 10 000 000	F
$ 10 000 001 to $ 15 000 000	G
$ 15 000 001 to $ 30 000 000	H
$ 30 000 001 to $ 50 000 000	I
$ 50 000 001 to $ 75 000 000	J
$ 75 000 001 to $ 100 000 000	K
Over $ 100 000 000	L

The letter designation will be published as part of the Bid Package.

TC-2.02 IN-STATE PREFERENCE – Reserved.

TC-2.03 VALUE ENGINEERING CHANGE PROPOSALS.

The Contractor may submit to the Engineer, in writing, value engineering change proposals (VECP) for modifying the Contract Documents for the purpose of reducing the total cost of Construction without reducing design capacity or quality of the finished product. The Engineer will then forward the VECP to the Department's Chief of the Bureau of Engineering and

Construction with recommended action. The decision to accept or deny the VECP will be made by the Department's Chief of the Bureau of Engineering and Construction. The Department's Chief of the Bureau of Engineering and Construction will be the sole and final judge of the acceptability of a VECP. The County will not consider appeals once this final decision is made. If a VECP is accepted by the County, net savings resulting from that VECP will be equally divided by the County and the Contractor. The Contractor may elect to pursue one of the following options when submitting a VECP:

Option 1 - Submit revised Plans, Contract Documents and estimate of savings to reflect the VECP; or

Option 2 - Submit a written concept of the VECP for tentative approval and if accepted, submit the detailed Plans, Contract Documents, and estimate for final approval at a later date.

Each VECP shall result in a net savings to the Contract cost without impairing essential functions and characteristics of the Contract Items or of any other part of the Work, including but not limited to service life, reliability, economy of operation, ease of maintenance, desired aesthetics and safety.

As a minimum, the Contractor shall submit the following information before final approval of a VECP may be given:

(a) A statement that the revised Plans, Contract Documents, and estimate of savings are submitted as a VECP.

(b) A statement concerning the basis for the VECP and benefits to the County together with an itemization of the Contract Items and requirements affected by the VECP.

(c) A statement describing in detail any and all potential impacts to public convenience and/or safety.

(d) A detailed estimate of the cost under the existing Contract and under the VECP.

(e) Plans, Contract Documents and recommendations as to how the VECP changes shall be accomplished.

(f) A statement as to the time by which an Extra Work Order adopting the VECP must be issued so as to obtain the maximum cost effectiveness. Typically, the County will require at least four (4) weeks to review and approve a VECP.

(g) A revised Baseline schedule showing the impact of the VECP, and including in that revised Baseline schedule a four (4) week allowance for the County's review of such VECP.

(h) The Contractor's engineering cost for the VECP.

The County will process the VECP in the same manner as prescribed for any other Contract Modification which would necessitate issuance of an Extra Work Order. The County may accept in whole or in part any VECP by issuing an Extra Work Order which will identify the VECP on which it is based. The County will not be liable to the Contractor for failure to accept or act upon any VECP submitted pursuant to these requirements nor for any delays to the Work attributable to any VECP. Until a VECP is effected by a Contract Modification, the Contractor shall remain obligated to the terms and conditions of the existing Contract. If an executed Extra Work Order has not been issued by the date upon which the Contractor's VECP specifies that a decision thereon should be made, or any other date as the Contractor may subsequently have specified in writing, the VECP shall be deemed rejected. The Extra Work Order effecting the necessary Contract Modification will establish the net savings agreed upon, will provide for adjustment in the Contract prices and/or Contract Time and will indicate the net savings to be equally divided between the Contractor and the County. The Contractor's costs for preparation of the VECP and the County's costs to review and administer the VECP will be deducted from the gross savings. The County reserves the right to include in the Contract any conditions it deems appropriate for consideration, approval and implementation of the VECP. The Contractor's fifty (50%) percent share of the net savings shall constitute full compensation for effecting all changes pursuant to the Contract. Acceptance of the VECP and performance of the Work thereunder will not change the Contract Time, unless specifically provided for in the Contract Modification authorizing the VECP.

The County expressly reserves the right to adopt a VECP for general use in contracts administered by the County when it determines that the VECP is suitable for application to other contracts. VECPs identical or similar to previously submitted VECPs will be eligible for consideration and compensation under these provisions if such VECPs were not previously adopted for general application to other contracts administered by the County. When a VECP is adopted for general use, compensation pursuant to these requirements will be applied only to those contracts Awarded and for which the subject VECP has been submitted prior to the date of adoption of the specific VECP.

Proposed changes in the basic design of a Bridge or pavement type, or requiring modification to the Right-of-Way limits, will not normally be considered as an acceptable VECP. Quantity decreases or elimination of any Contract Items as a result of changing field conditions, errors, etc. will not be considered as an acceptable VECP. If a VECP is based upon or similar to a change in the Plans, Contract Documents or Special Provisions adopted by the County prior to submission of the VECP, the County will not accept the VECP.

These requirements apply to all VECPs initiated and developed by the Contractor and which are identified as such by the Contractor at the time of its submission to the Engineer; however, nothing herein shall be construed as requiring the Engineer to consider or approve a VECP submitted by the Contractor.

Subject to the provisions contained herein, the County or any other public agency shall have the right to use all or part of any accepted VECP on other contracts without obligation or compensation of any kind to the Contractor.

In the event a VECP is accepted by the County, the provisions of the Contract Documents which pertain to adjustment of Contract unit prices due to alterations of Contract quantities will not apply to the items adjusted or deleted as a result of effecting the VECP by Contract Modification.

TC-2.04 OWNER/OPERATOR.

For the purpose of labor compliance, the term "Owner/Operator" shall be defined as being the individual who owns and operates his/her own vehicle.

The prevailing wage rates shall not apply to a "Owner/Operator". However, they shall appear on the payroll of the Contractor or Subcontractor with the notation "Owner/Operator".

Employees of an "Owner/Operator" shall be subject to prevailing wage rates and shall appear on a certified payroll.

TC-2.05 DEBARMENT/SUSPENSION.

Pursuant to the emergency regulations which were approved by the AELR Committee of the State General Assembly on July 27, 1982, and which went into effect on July 28, 1982, the State Department of Transportation, State Highway Administration, pursuant to applicable laws and regulation, established a list of "Debarred or Suspended Contractors."

The current list of "Debarred or Suspended Contractors or Suppliers" is available at the Baltimore County Department of Public Works, 111 West Chesapeake Avenue, Room 300, Towson, Maryland 21204, for inspection by all interested parties.

TC - SECTION 3
SCOPE OF WORK

TC-3.01 GOVERNING ORDER OF CONTRACT – Reserved.

TC-3.02 CONSTRUCTION DOCUMENTS TO SUCCESSFUL BIDDER – Reserved.

TC-3.03 CONTINGENT ITEMS – Reserved.

TC-3.04 WARRANTY OF CONSTRUCTION – Reserved.

TC-3.05 RIGHTS IN AND USE OF MATERIALS FOUND ON THE WORK SITE.

The Contractor may use on the Contract any excavated stone, gravel, sand or other Material found on the Work site that conforms to the requirements of the Contract Documents and are approved by the Engineer.

When these Materials are used for select, capping, modified, or common borrow and conform to the pertinent Contract provisions and Contract Documents, payment will only be made at the Contract unit price for the class of excavation from which the Materials are obtained.

In the event these Materials are processed through a crushing, screening, washing or sorting plant for use as another Pay Item, the Contractor will be paid both for the excavation of such Materials at the Contract unit price and at the Contract unit price for which the Material is used. The Contractor shall replace at its own expense with other acceptable Material all of the portion of the excavated Material removed and used which was needed for use in the embankments, backfills, approaches or otherwise.

If, however, these Materials are not processed and paid for as described in the preceding paragraph, and their use creates a shortage of embankment or other Material, the Contractor shall provide acceptable replacement Material for all Material needed for embankment, backfill, approaches or otherwise.

The replacement Material shall be paid for at the Contract unit price Bid for the Contract Item that the Class I Excavation is used for, or the Contract unit price Bid for Class I Excavation, whichever is the lowest Contract unit price Bid.

The Contractor shall not excavate nor remove any Material which is not within the limits of excavation, as indicated by the Slope and grade lines, without written authorization from the Engineer.

TC-3.06 SAFETY HAZARDS IN CONFINED SPACES – Reserved.

TC - SECTION 4
CONTROL OF WORK

TC-4.01 WORKING DRAWINGS.

(a) General. The Plans will be supplemented by Working Drawings as necessary to adequately control the Work. All alterations affecting the requirements and information given on the Working Drawings shall be authorized in writing to the Engineer. When at any time reference is made to the Working Drawings, the interpretation shall be the Working Drawings as affected by all authorized alterations then in effect.

Working Drawings will show details of all Structures, lines, grades, typical cross section of Roadway, general cross sections, location and designation of all units and elements.

The Contractor shall provide, at the Contractor's expense, all required Working Drawings and shall have them adequately checked, after which they shall be submitted to the Engineer for review. The Engineer may reject Working Drawings and return them for revisions, in which case the Contractor shall submit revised Working Drawings as required. No Contract Items involving the Working Drawings shall be incorporated into the Work until those Working Drawings have been accepted for use by the Engineer; however, acceptance shall not relieve the Contractor of any responsibility in connection therewith. All Working Drawings shall be furnished in duplicate for preliminary examination for Contracts prepared by the Administration and in triplicate for Contracts prepared by consultant engineering firms for the Administration. After Working Drawings have been accepted for use by the Engineer, the Contractor shall furnish additional copies as requested.

All Working Drawings shall be on sheets measuring twenty-two inches (22") by thirty-six inches (36") or as required by the Engineer and shall have a standard title block at the lower right corner approximately four inches (4") by eight inches (8") (two inches (2") for the revision column on the left side and the remaining six inches (6") for the title) indicating the following information in the order named:

Name of Contractor (and Subcontractor, if applicable)
Address of Contractor (and Subcontractor, if applicable)
Sheet Title (Reinforcement Details, etc.)
Name of Structure Crossing
For (Baltimore County)
By (Indicate name of Contractor's official or engineer, or other parties authorized to sign official documents.)

All Working Drawings shall list all County Contract Numbers, complete federal aid number, if any, and the date the Working Drawing was completed. The left portion of the title block shall be headed "Revisions" and the space used as needed.

Working Drawings for standard scuppers are not required. A sketch or statement specifying the type and number of standard scuppers required and the length of the downspout is acceptable.

(b) **Working Drawings for Falsework Systems.** Falsework systems Plans (design and Construction) shall be the responsibility of the Contractor, including submitting and obtaining written acceptance of the design and Plans by the Engineer before erection. The Contractor shall utilize a professional engineer (P.E.) registered in the State who has a minimum of five (5) years experience in falsework design for Bridge Construction and Repair. The falsework design calculations and Plans shall be signed by the P.E. and bear the seal of the P.E. The submittal of the design and falsework Plans shall include the P.E.'s resume showing evidence of the required experience.

The P.E.'s Plans and design calculations shall evaluate and qualify all products and components including manufactured products and proprietary items for their intended service. Acceptance by the Engineer of falsework systems shall not in any way relieve the Contractor of the responsibility for the safety and adequacy of the design and Construction for the falsework

systems and operations, including all components. Every Structure in the Contract will require a separate falsework design analysis, separate Plans, and separate design submittals as set forth above. This applies even though Structures may appear to be identical.

Each falsework system shall be designed to have the capacity to support all vertical and horizontal loading with enough redundancy to prevent progressive failure. Vertical loading, differential settlement forces, live load where applicable and all horizontal lateral and longitudinal forces shall be taken into account. Unbalanced temporary loading caused by placement sequence shall also be provided for in the design. Adequate diagonal bracing in all planes shall be employed.

All falsework systems designs and Plans shall provide for adequate foundations with bearings below the frost line or on rock or on piling and for possible settlement. If additional subsurface data is necessary, it shall be obtained and analyzed by the Contractor for proper design of the Plans and performance of Construction.

Falsework designs and Plans shall include protection against impact from uncontrolled Highway vehicles, accidental collision of a crane boom or other Construction Equipment and vehicles, traffic vibration, flood waters, high winds and any other envisioned contingent situations.

TC-4.02 FAILURE TO ADEQUATELY MAINTAIN PROJECT – Reserved.

TC-4.03 USE PRIOR TO COMPLETION – Reserved.

TC-4.04 WORK SUSPENSION – Reserved.

TC - SECTION 5
LEGAL RELATIONS AND PROGRESS

TC-5.01 INSURANCE – Reserved.

TC-5.02 NOTICE TO PROCEED – Reserved.

TC-5.03 SUBCONTRACTORS – Reserved.

TC-5.04 CULTURAL RESOURCES – Reserved.

TC-5.05 DETERMINATION AND EXTENSION OF CONTRACT TIME – Reserved.

TC - SECTION 6
RESTRICTIONS AND PERMITS

TC-6.01 MOVING OF EQUIPMENT.

(a) The Contractor will not be permitted to move over or operate on any Road (except on the Road under Construction) any power shovels, rollers, concrete mixers, cranes, tractors or any other heavy Equipment of weight or dimensions in excess of State Motor Vehicle Law or Administration's regulations without first obtaining the applicable permit. In case of permits for oversize and overweight vehicle movements, attention is directed to State Motor Vehicle Laws requiring the Administration to collect a fee on every such vehicle movement using Highways of the State. The payment of and securing of such permit is required irrespective of whether the movement is in connection with a subject Contract or for other purposes.

(b) The Contractor shall adhere to all State and local laws and regulations including but not limited to all State Motor Vehicle Laws and safety regulations.

TC-6.02 RESTORATION OF SURFACES OPENED BY PERMIT.

The right to construct or reconstruct any utility in a County Highway or to grant permits for same at any time is reserved by the Administration.

Upon the presentation of a duly authorized and satisfactory permit which provides that all necessary Repair Work shall be paid for by the party to whom such permit is issued, the Contractor shall allow parties bearing such permits to make openings in a County Highway.

The Contractor shall, when ordered by the Engineer, make in an acceptable manner all necessary Repairs due to such openings, and such necessary Work will be paid for as Extra Work, as provided in these Standard Specifications, and will be subject to the same conditions as original Work performed.

TC-6.03 RAILROAD HIGHWAY GRADE CROSSINGS AND SEPARATIONS.

When the Contractor is required to haul Materials across the tracks of any railroad, or elects to do so, the Contractor shall coordinate with and make arrangements with that railroad for any new private crossings or for the use of any existing private crossing in accordance with the terms and conditions of any permit issued by the applicable railroad.

All Work to be performed by the Contractor in the Construction of railroad-Highway separation Structures on the railroad right-of-way shall be done in a manner satisfactory to the railroad company and shall be performed at such times and in such manner as not to unnecessarily interfere with the movement of trains or traffic upon the tracks of the railroad company. The Contractor shall use care and precaution in order to avoid accidents, damage, or unnecessary delay or interference with the railroad company's trains or other property. In addition to the insurance specified in GP-7.14 and when Work covered under the Contract is to be performed on

or about the rails of a railroad's tracks, the Contractor shall be required to carry Contractor and railroad public liability and property damage insurance as specified in the Contract Documents and/or required by the applicable railroad.

Prospective Bidders on Contracts crossing railroad right-of-way are advised that the railroad company will require the Contractor to obtain, pay for and have approved by the railroad, certain railroad forms of public liability and property damage insurance policies before entering upon the railroad property. Details of such policies may be set forth in the Contract Documents; but in case of omission from the Contract Documents, the Contractor shall and is required to communicate with the railroad to ascertain the type of insurance required, if any, and make provisions for same in its Bid.

Unless otherwise specified, cost for the insurance policies whether described in the Contract Documents or ascertained by the Contractor will not be paid for by the County. The cost for any and all insurance related to a railroad company will be incidental to the other Contract Items specified in the Contract Documents and be the sole responsibility of the Contractor.

All Work on portions of Structures over railroad right-of-way shall conform to all rules and regulations of the owners of the right-of-way, including, but not limited to, any applicable railroad company. The Contractor is responsible for acquiring full knowledge of these rules and regulations and complying therewith to the satisfaction of the owners of the railroad right-of-way, including, but not limited to, any applicable railroad company.

TC-6.04 BRIDGES AND OTHER WORK IN OR OVER WATERS OF THE STATE.

All Work in, on or over waters under control of the United States Department of the Army and the Environmental Protection Agency of the United States shall conform to all applicable federal permits, rules and regulations. All such rules and regulations are hereby part of and incorporated into the Contract. The Contractor is cautioned and charged with the responsibility of obtaining complete knowledge thereof and compliance therewith.

The Contractor shall also comply with the provisions of all other applicable federal, State and local laws, permits, rules and regulations, and shall be knowledgeable of any and all pertinent laws and regulations of the State Department of Natural Resources and Maryland Department of Environment. All such laws, permits, rules and regulations are also hereby part of the Contract.

TC-6.05 USE OF EXPLOSIVES.

All blasting operations, including the storage and handling of explosives and blasting agents, shall be performed in conformance with the applicable provisions of the Standard Specifications and all other pertinent federal, State, and local laws and regulations. Whenever explosives are used, they shall be of such character and in such amount as is permitted by the State and local laws and ordinances and all respective agencies having jurisdiction over them.

The Engineer will at all times have the authority to prohibit or halt the Contractor's blasting operations if it is apparent that, through the methods being employed, the required results are not

being obtained, an unstable condition exists, or the safety and convenience of the public is being jeopardized. The Contractor shall not damage any adjacent property or Structures. A pre-blasting and post-blasting survey inspection is required to be performed by the Contractor.

(a) **Blasting Plan Required.** Not less than two (2) weeks prior to commencing drilling and blasting operations, or at any time the Contractor proposes to change the drilling and blasting methods, the Contractor shall submit a blasting plan to the Engineer for review. The blasting plan shall contain the full details of the drilling and blasting patterns and controls the Contractor proposes to use. The blasting plan submittal is for quality control and record keeping purposes.

Review of the blasting plan by the Engineer shall not relieve the Contractor of the responsibility for the accuracy and adequacy of the plan when implemented in the field. If at any time during the progress of the Work the method of drilling and blasting does not produce the desired result, the Contractor shall submit a revised blasting plan until a technique is arrived at that shall produce the desired results.

(b) **Responsibility.** Control of blasting is a major responsibility of the Contractor. The Contractor shall execute vibration control and shall at all times be responsible for damage caused by vibrations due to blasting or any of the Contractor's other operations.

(c) **Extraordinary care.** When the use of explosives is necessary for the prosecution of the Work, the Contractor shall use extraordinary care so as not to endanger life or property. Before the firing of any blast in areas where flying rock may result in personal injury or unacceptable damage to property or the Work, the rock to be blasted shall be covered with approved blasting mats, soil, or other equally serviceable material, to prevent flyrock.

(d) **Safeguard of Public.** The Contractor must safeguard the traveling public during dynamiting operations. The Contractor shall use enough watchmen, flagmen, signs, etc. to warn the public including, but not limited to, motorists and pedestrians during blasting.

(e) **Storage.** The Contractor shall store all explosives in a secure manner and shall clearly mark storage places "DANGEROUS - EXPLOSIVES". The storage places must be in the care of competent watchmen at all times and all explosives shall be stored and handled according to the provisions of the statutes of the State and local laws and ordinances.

(f) **Permits & Insurance.** Before any blasting is done, the Contractor shall apply for and obtain a blasting permit from the applicable governing authority. Insurance shall be maintained and certified as specified in GP-7.14.

(g) **Protection of Underground Utilities.**

(1) The Contractor shall ensure the protection of underground utilities. The Contractor shall notify each public utility company and those applicable Utility Companies having Structures close to the site of Work of the Contractor's intentions to use explosives. The notice must be given far enough in advance to enable all Persons and the Utility Companies to take such steps as they deem necessary to protect their property from injury. Such notice does

not relieve the Contractor of responsibility for any damage resulting from Contractor's blasting operations.

(2) At and below the elevation of the top of the buried utility line, the vertical depth of blast holes shall be restricted to one-half the horizontal distance to the closest portion of the utility. The blast hole shall be restricted to a maximum of three inches (3"), with no more than one hole per delay.

(h) **Peak Particle Velocity.** When blasting has to be done next to a Structure, the Contractor shall ensure that the "Peak Particle Velocity" at the Structure does not exceed 0.50 inches/second for frequencies less than 40 Hz. The "Peak Particle Velocity" is the maximum of the three-velocity components measured at a point with a three-component vibration recording instrument capable of producing a permanent record.

(i) **Maximum charge weight.** If a scaled distance, as defined below, of seventy (70) or greater is used with minimum delays of ten (10) milliseconds, the following formula may be used to determine the maximum charge weight per delay which can be used without seismic instrumentation:

Scaled Distance = Actual Distance to Damage Point in Feet (Charge Weight in Pounds per delay) $^{1/2}$

Charge Weight in = (Actual Distance to Damage Point in feet) squared pounds per Delay (Scaled Distance) squared

(j) **Blast holes.** Blast holes are to be limited to three inches (3") in diameter. Prepackaged material only shall be used with no free flowing explosive permitted.

(k) **Use of Explosives Within State Road Right-of-Way.**

(1) The use of explosives is not permitted within rights-of-way of the State Highway Administration (SHA) except when specifically allowed under a SHA permit or by amendment of the same. The Contractor shall conduct and perform all blasting operations according to the permit and/or any addenda issued.

(2) Before using any explosives, notify the following office:

Utility Division
Maryland State Highway Administration
District No. 4
320 West Warren Road
Hunt Valley, Maryland 21030
Telephone (410) 229-2300

(l) Each blasting shall be seismographically recorded by the Contractor and the Contractor shall send a copy of the report to the SHA Highway District Utility Engineer at the above

address.

(m) Use of explosives. The use of explosives is not permitted within railroad rights-of-ways except when specifically allowed under a railroad permit or by amendment of the same. All blasting operations shall be conducted and performed according to the permit and/or any addenda issued.

(n) Payment for blasting. Payment of all blasting operations, control measures and monitoring systems shall be included in the unit price Bid for each Contract Item for which blasting is required.

TC-6.06 AERIAL ELECTRIC LINES (750 VOLTS OR MORE).

The Contractor shall be aware that State law requires that a ten foot (10') radial clearance shall be maintained for all Construction Equipment and Materials in relation to electric lines carrying seven hundred fifty (750) volts or more. Because the State law is more stringent than the federal laws, the State law shall be considered the minimal distance.

The Contractor shall also be aware of, and comply with, all other federal, State, County and local laws, utility company requirements and regulations, as specified in GP-7.01 "Compliance With Laws".

TC-6.07 LOAD AND SPEED LIMITATIONS – Reserved.

TC-6.08 HAZARDOUS MATERIAL.

If the Contractor encounters or exposes during Construction any abnormal conditions which indicate the presence of a hazardous material or toxic waste, Work in the area shall immediately be suspended and the Engineer notified in writing. The Contractor's operations in this area shall not resume until permitted in writing by the Engineer; however, the Contractor may continue working in other areas of the Work site, unless directed otherwise.

Abnormal conditions shall include, but not be limited to, the presence of barrels, obnoxious or unusual odors, excessively hot earth, smoke, or any other condition which could be a possible indicator of hazardous material or toxic waste.

Disposition of the hazardous material or toxic waste shall be made in conformance with all applicable laws, requirements and regulations. Where the Contractor performs necessary Work required to dispose of these Materials and no Contract Items have been identified in the Contract Documents, the Work shall be performed under an Extra Work Order.

For any Material furnished in connection with the Contract and/or on the Work site by the Contractor that is suspected to be hazardous or toxic, the Engineer may require the Contractor to have it tested and certified to be in conformance with all applicable requirements and regulations. Material found to be hazardous or toxic shall not be incorporated into the Work.

The required testing will be determined by the Engineer and may include, but not be limited to, the EPA Toxicity Characteristic Leaching Procedure (TCLP) or its successor. The evaluation and interpretation of the test data will be made by the Engineer. Testing and Certification shall be at the Contractor's sole expense.

TC-6.09 RECYCLED OR REHANDLED MATERIALS.

For recycled or rehandled Material furnished on the Work site by the Contractor for use in embankment, base, Subbase or drainage media, the Engineer may require the Contractor to have the Material tested and certified to be in conformance with all applicable environmental requirements. The required testing will be determined by the Engineer and may include, but not be limited to, the EPA Toxicity Characteristic Leaching Procedure (TCLP) or its successor. The evaluation and interpretation of the test data will be made by the Engineer and be based on the Work site environment. Testing and Certification shall be at the Contractor's sole expense.

TC-6.10 CONSTRUCTION AND WASTE MATERIAL.

All wood, trash, debris, and other foreign matter shall be removed from within the Right-of-Way limits and disposed of by the Contractor. The Contractor shall make all necessary arrangements to obtain suitable disposal locations at the Contractor's sole expense. Disposal shall be in conformance with all federal, State and local ordinances.

TC - SECTION 7
PAYMENT

TC-7.01 MEASUREMENT OF QUANTITIES – Reserved.

TC-7.02 PAYMENT ALLOWANCES FOR STORED MATERIALS – Reserved.

TC-7.03 FORCE ACCOUNT WORK – Reserved.

TC-7.04 PROGRESS PAYMENTS – Reserved.

TC-7.05 FINAL ACCEPTANCE AND FINAL PAYMENT– Reserved.

TC-7.06 LATE PAYMENTS – Reserved.

351.03.10 Chlorination, Bacteriological, Hydrostatic and Leakage Tests.

(b) Water Samples. Baltimore City Bureau of Water and Wastewater will perform bacteriological testing for the disinfection of water mains and storage facilities according to ANSI/AWWA C651, Section 5.1.1, 5.1.2, 5.1.4, and 5.2. It is required that two consecutive sets of samples be taken at least 24 hours apart and deemed acceptable by bacteriological standards before a water main or storage facility can be placed into service.

The engineer will collect water samples and provide for their analysis for bacteriological quality. Samples must arrive at the Water Quality Lab no later than 6 hours after being taken. Because bacteriological analysis will be run on samples received in the lab by 1:00 pm, all field sampling must be completed by 12:00 noon. Results will be available after 3:00 pm the following day, as the results require a full 24 hour incubation period.

SECTION III

SPECIAL PROVISIONS

EXECUTIVE ORDER

USE OF MINORITY BUSINESS ENTERPRISES AND WOMEN'S BUSINESS ENTERPRISES IN COUNTY CONTRACTS

WHEREAS, Baltimore County, Maryland recognizes the important contributions made by Minority Business Enterprises and Women's Business Enterprises to the overall economic health of the region; and

WHEREAS, it is the goal of this Administration to provide maximum opportunities for Minority Business Enterprises and Women's Business Enterprises to participate in all phases of procurement in the county, including construction, purchases of goods and services, architectural and engineering agreements, consultant contracts and other professional service agreements;

NOW, THEREFORE, it is this 4th day of June, 2009, by the County Executive of Baltimore County, Maryland, ordered that the March 5, 2004 Executive Order, Utilization of Minority Business Enterprises and Women's Business Enterprises in County Contracts, is hereby repealed and replaced by the following:

SECTION 1. DEFINITIONS.
In this Executive Order, the following words have the meanings indicated:

(A) (1) "Discretionary dollars" means dollars spent in county procurements from county capital funds and county operating funds.

(2)(I) "Discretionary dollars" does not include dollars spent on procurements or classes of procurements for which the county is not able to control or influence the utilization of MBE or WBE firms.

(II) These procurements are likely to include or involve:

(a) other governmental or quasi-governmental agencies;
(b) utilities;
(c) proprietary items;
(d) emergency procurements; and
(e) operating grants to arts entities.

(B) "Minority Business Enterprise" or "MBE" means a business enterprise that is owned, operated and controlled by one or more minority group members (African American, Hispanic American, Asian American, or Native American) who have at least 51% ownership and in which the minority group members have operational and managerial control, interest in capital, and earnings commensurate with their percentage of ownership.

(C) "Women's Business Enterprise" or "WBE" means a business enterprise that is owned, operated, and controlled by one or more women who have at least 51% ownership and in which the women have operational and managerial control, interest in capital and earnings commensurate with their percentage of ownership.

(D) "Waiver" means an adjustment to the MBE/WBE goals established by the Procurement Review Group for a solicitation that may be requested by a bidder at the time of bid submission.

SECTION 2. MINORITY AND WOMEN'S BUSINESS ENTERPRISE GOALS.

(A) An overall goal of 15% of the cumulative total of all discretionary dollars spent in a fiscal year of county procurements is to be awarded to and/or performed by MBE and WBE firms.

(B) All county offices and departments shall make good faith efforts to equitably use the services of MBE and WBE firms.

(C) The Office of Fair Practices and Community Affairs (hereinafter "Office of Fair Practices") shall submit to the County Executive an annual written report on the efforts made in accordance with this section.

(D) All contracts or other agreements between Baltimore County and other governmental agencies, quasi-governmental agencies, developers, or any other parties, involving the provision of discretionary dollars from or through the county for the purpose of contracting with such entities to acquire and build, renovate, rehabilitate, demolish or otherwise perform a public works function shall include provisions regarding participation by MBE firms and WBE firms consistent with this Executive Order.

SECTION 3. PROCUREMENT REVIEW GROUP

(A)(1) There is a Procurement Review Group that, at a minimum, shall consist of at least one representative from:

(I) The Office of Budget and Finance;
(II) The Department of Public Works; and
(III) The Office of Fair Practices.

(2) The Chairman of the Procurement Review Group may request the presence and participation (without voting rights) of representatives from other agencies.

(B) The representative from the Office of Fair Practices shall serve as the Chairman of the Procurement Review Group.

(C) (1) The Procurement Review Group shall review bid solicitations involving discretionary dollars to determine whether opportunities exist for MBE or WBE participation or both MBE and WBE participation.

(2) The Procurement Review Group may make recommendations for dividing total requirements of a solicitation into smaller contracts or shorter terms to allow maximum MBE or WBE participation or both MBE and WBE participation.

(3) (I) The Procurement Review Group may recommend that the minimum MBE or WBE participation or both MBE and WBE participation in an individual procurement or class of procurements be more or less than the 15% overall goal established in Section 2, as appropriate.

(II) Any recommendation that the minimum MBE or WBE participation or both MBE and WBE participation in an individual procurement or class of procurements be more or less than the 15% goal established in Section 2 shall be reasonable and shall reflect the number of willing and able firms available to perform the items of work to be subcontracted.

(D) (1) The Procurement Review Group may adopt rules of procedure for the conduct of its business.

(2) The rules may include:

(I) rules and standards for evaluating and determining MBE and WBE goals for solicitations;

(II) rules for evaluating requests for waivers; and

(III) refinements to the definition of "discretionary dollars."

(E) The Procurement Review Group shall meet regularly as determined by the Chairman.

SECTION 4. SOLICTATIONS - OPPORTUNITIES.

In accordance with the recommendations of the Procurement Review Group, the Office of Budget and Finance and the Department of Public Works shall:

(1) To the extent practicable and consistent with other provisions of this Executive Order, take the steps outlined in this Section to ensure that MBE firms and WBE firms have maximum opportunity to participate on county contracts;

(2) Use best practices (which may include, but not be limited to, use of the county website, advertisement in newspapers, and other media outlets) to notify MBE and WBE firms of bid solicitations in accordance with Section 6 (Formal Bid Procedure) of the Purchasing Manual;

(3) Inform all prospective bidders of the county's policy concerning MBE and WBE participation during the solicitation phase of the bid process; and

(4) To the extent practicable, divide total requirements of a solicitation into smaller contracts or shorter terms to allow maximum MBE and WBE participation.

SECTION 5. AGENCY RESPONSIBILITIES.

(A) It shall be the responsibility of the Office of Fair Practices to ensure that county offices and departments adhere to the procedures and provisions of this Executive Order.

(B) The Office of Fair Practices shall:

(1) Post a list of certified MBE and WBE subcontractors on the county website;

(2) On request, provide a list of certified MBE and WBE subcontractors to prospective bidders; and

(3) Assume primary responsibility for reviewing, on a continuing basis, all aspects of the use of Minority Business Enterprises and Women's Business Enterprises in county contracts to assure that the purpose of this Executive Order is being achieved.

(C) The Department of Public Works shall:

(1) Post lists of pre-qualified consultants and contractors on the county website; and

(2) On request, provide a list of pre-qualified consultants and/or contractors to MBE and WBE subcontractors.

(D) The Office of Fair Practices and the Office of Budget and Finance shall jointly:

(1) Assist county offices and departments in identifying qualified certified MBE and WBE firms ready and able to provide services, equipment, materials and supplies to the county;

(2) If applicable, attend pre-bid meetings and bid openings to provide information to prospective bidders about the county's policy with respect to MBE and WBE participation;

(3) Review MBE and WBE participation plans submitted by general contractors to determine whether goals are being achieved;

(4) Provide outreach services to MBE and WBE firms by working closely with the Department of Public Works; and

(5) Provide periodic reports to the County Executive and County Council.

SECTION 6. BID REQUIREMENTS.

(A) (1) All bidders shall submit a list of all subcontractors contacted in preparation of their bid package or proposal.

(2) The list shall include the service to be performed, bid amount, and the race/ethnicity/gender of the business owner(s).

(B) (1) All bidders shall submit a list of all subcontractors to be used on a county contract in the bid package.

(2) This list shall include all subcontractors (both MBE/WBE and non-MBE/WBE) used, the service to be performed, the total amount to be paid, and the race/ethnicity/gender of the owner.

(C) Bidders (including certified MBE/WBE prime consultants and general contractors) shall make a good faith effort to meet the goals established in a bid for a project.

(D) Subject to subsection (E) of this Section, a bidder shall be deemed non-responsive if:

(1) The bidder does not comply with Subsections (A), (B), and (C) of this Section; or

(2) The bidder does not meet the goal established by the Procurement Review Group.

(E) (1) If a bidder is unable to comply with the goals established in a bid for a project, the bidder may submit a request for a waiver at the time of bid submission.

(2) The request for waiver shall include documentation that demonstrates the bidder's good faith efforts to comply with the goals, including:

(I) Signed unavailability statements from all MBEs and WBEs that the bidder solicited for participation; and

(II) Copies of solicitation documentation to all potential subcontractors, including:

(a) Emails, letters, facsimile transmittals and confirmations containing plans, specifications, and anticipated time schedule for portions of the work to be performed and meeting notes and agendas clearly identifying the certified MBE or WBE classification and dates that the bidder contacted each; and

(b) Telephone logs containing names, addresses, dates, telephone numbers, work to be performed, anticipated time schedule and classification of certified MBEs and WBEs contacted.

SECTION 7. CERTIFICATION.

In calculating the county's success in achieving the goals established in this Executive Order, the county may include the following:

(1) On contracts that have MBE/WBE subcontracting requirements, only the participation by subcontractors certified by the Maryland Department of Transportation or Baltimore City's Minority Business Office Certification shall be counted;

(2) For contracts by the Office of Budget and Finance, contracts with non-certified prime contractors who certify their status as an MBE/WBE under oath or Prime contractors certified by any jurisdiction as an MBE/WBE shall be counted toward the MBE/WBE participation; and

(3) For Public Works contracts, only prime consultants and general contractors certified by Maryland Department of Transportation or Baltimore City's Minority Business Office Certification programs shall be counted toward the MBE/WBE participation.

SECTION 8. EFFECTIVE DATE.

This Executive Order shall take effect on the day it is signed by the County Executive and shall continue in effect until changed by another Executive Order.

ATTEST:

Peter O'Malley
Chief of Staff to the County Executive

James T. Smith, Jr.
County Executive

Reviewed for legal form and sufficiency
and approved for execution

6-4-09

Office of the County Attorney Date

BALTIMORE COUNTY, MARYLAND
MBE/WBE PARTICIPATION SUMMARY

Executive Order: Minority business enterprises and women business enterprises (MBE/WBE) shall have the maximum opportunity to participate in the performance of contracts financed in whole, or in certain circumstances, in part with County funds. Accordingly, on June 4, 2009, the County Executive adopted the attached Executive Order addressing MBE/WBE participation in County contracts.

Each Contract: The County shall establish a minimum MBE/WBE participation amount for each contract, as applicable.

Bidder Responsibility: The bidder shall ensure that MBE/WBE participation occurs in accordance with the contract requirements and the County Executive's Executive Order. All bidders shall ensure that MBE/WBE have the maximum opportunity to compete for and perform County contracts, as applicable. Baltimore County, Maryland, and/or its bidders and contractors shall not discriminate on the basis of race, color, national origin, disability or sex in the award and performance of any County contract.

APPROVED MBE/WBE LISTINGS

Published compilations of approved and certified MBE/WBE, contractors, subcontractors, material suppliers, etc. include:

1. BALTIMORE COUNTY MINORITY AND WOMEN BUSINESS ENTERPRISE DIRECTORY (PRISM):
   http://www.baltimorecountymd.gov/Agencies/fairpractices/minoritybusiness/directory.html
2. DIRECTORY OF MINORITY BUSINESS ENTERPRISE (MDOT):
   http://mbe.mdot.state.md.us/directory/search_select.asp
3. MINORITY BUSINESS DIRECTORY OF THE CITY OF BALTIMORE:
   http://cityservices.baltimorecity.gov/mwboo/

BIDDER'S ACTIONS

Seeking Commitments: The bidder will seek commitments by subcontract or otherwise from MBE/WBE for supplies and/or services, any combined value of which equals or exceeds the required percentage of MBE/WBE participation for the County contract.

Expenditures for Materials and Supplies: A bidder may count toward its MBE/WBE contract requirements, all expenditures for materials and supplies obtained from MBE/WBE suppliers and manufacturers, provided that the MBE/WBE assumes the actual and contractual responsibility for the provision of the materials and supplies.

Information to be Supplied: All bidders shall submit the following information to the County at the time of bid submission:

1. The name of an employee designated as the bidder's liaison to the County's Office for Fair Practices.
2. The following forms shall be completed and submitted
   - Certified MBE/WBE Utilization and Fair Solicitation Affidavit (**Form A);** from among those names appearing in the Approved MBE/WBE Listings (excepting Federal Highway Administration projects, which exclusively require MBE/WBE approved and certified by the Maryland Department of Transportation Certification Committee);
   - A MBE/WBE Participation (**Form B**) completed and signed by the prime contractor and MBE/WBE for each MBE/WBE listed on the Form.
   - A MBE/WBE Disclosure and Participation Statement (**Form C**) completed and signed by the prime contractor and MBE/WBE for each MBE/WBE listed on the Form.

- If applicable, MBE/WBE Subcontractor Unavailable Certificate (**Form D**) completed and signed by the prime contractor and MBE/WBE for each MBE/WBE listed on the Form.

- If applicable, MBE/WBE Outreach Efforts - Compliance Statement (**Form E**) completed and signed by the Bidder.

3. If the bidder's proposed MBE/WBE participation does not meet the MBE/WBE contract requirements, information sufficient to demonstrate that the bidder has made every effort to meet the requirements must be submitted. (See DETERMINATION OF BID RESPONSIVENESS hereafter)

RECORDS AND REPORTS

Records to be Kept: The bidder must keep such records as are necessary to determine compliance with its MBE/WBE utilization requirements:

1. The MBE/WBE and non-minority contractors, type of work being performed, actual values of work and services.

2. Documentation of all correspondence, contacts, telephone calls, etc., to obtain MBE/WBE services for the contract.

3. All prime contractors and MBE/WBE sub-contractors are required to report monthly to the County through an online system called PRISM. If the contractor cannot submit his/her report on time, he/she will notify the County MBE/WBE office and request additional time to submit the report. Failure of the contractor to report in a timely manner may result in a finding of noncompliance. The County in its sole discretion and/or upon written request may require additional reports regarding MBE/WBE.

Retaining Records: All MBE/WBE records must be retained for 3 years following the expiration or any earlier termination of the contract and shall be available for inspection and photocopying by the County.

Investigation and Notification: Whenever the County believes the bidder, contractor, or any subcontractor may not be operating in compliance with the MBE/WBE requirements, the County may, in its sole discretion, conduct an investigation. If the County finds the bidder, contractor, or any subcontractor is not in compliance with the MBE/WBE requirements, the County may exercise any and all rights and remedies available to the County, under the contract, at law or equity, as deemed applicable and appropriate by the County in its sole discretion.

DETERMINATION OF BID RESPONSIVENESS

Request for Waiver: If the bidder is unable to procure from MBE/WBE's (by subcontract or otherwise), supplies and services, the overall goal percentage for the contract and/or the individual goal percentages for either the MBE or WBE – owned businesses, the bidder shall request, in writing, a waiver of the contract requirements. To obtain such a waiver, the bidder must submit the following information at the time bids are due:

The request for waiver request shall include (1) a signed unavailability statement (Form D) executed by all MBEs and WBEs that the bidder solicited for participation and (2) Outreach Efforts/Compliance Statement (Form E) that demonstrates the bidder's good faith efforts to comply with the contract requirements, including copies of solicitation documentation to all potential subcontractors:

Emails, letters, facsimile transmittals and confirmations containing plans, specifications, and anticipated time schedule for portions of the work to be performed and meeting notes and agendas clearly identifying the certified MBE or WBE classification and dates that the bidder contacted each MBE/WBE; and Telephone logs containing names, addresses, dates, telephone numbers, work to be performed, anticipated time schedule and classification of certified MBEs and WBEs contacted.

Bid Rejection/Liquidated Damages/Contract Breach: For Purchasing contracts, the apparent low bidder's failure to provide a responsive MBE/WBE Plan as required by the solicitation may result in the bidder being deemed non-responsive and the County's rejection of the bid. FOR DPW CONTRACTS, (a) THE SOLICITATION, INCLUDING BUT NOT LIMITED TO THIS MBE/WBE PARTICIPATION SUMMARY AND ALL RELATED COUNTY MBE/WBE DOCUMENTS, AND (b) THE BID RESPONSE SHALL COLLECTIVELY OVERRIDE, CONTROL AND GOVERN OVER Section GP 7.29 of the February 2000 *Baltimore County Department of Public Works' Standard Specifications for Construction and Materials*. For DPW contracts, the apparent low bidder's failure to provide a responsive MBE/WBE Plan in the bidder's response as required by (a) described above, may result in the Director of the Department of Public Works' determination that the bid is non-responsive and recommendation to reject the bid as non-responsive despite the bidder being the apparent low bidder. For DPW contracts, if the County awarded the contract to the apparent low bidder who provided a responsive MBE/WBE Plan, but, if after said award and before execution of Contract Documents, the apparent low bidder fails to comply with the MBE/WBE Plan as required in (a) and (b) above, such failure may result in the Director of the Department of Public Works' recommendation to annul the award and forfeiture of the bidder's Proposal Guaranty to the County, not as a penalty, but as liquidated damages sustained. In such case, the County may proceed as it determines to be in its best interest, including but not limited to, the Notice of Award may be made to the next lowest responsive and responsible bidder or the work may be re-advertised.

After execution of each and any applicable County contract, in the event a contractor becomes aware it may or will fail to fulfill the applicable MBE/WBE requirements and/or may or will deviate from the contractor's bid response/contract terms, the contractor shall promptly advise the County of this in writing. Thereafter, the County will determine what action or remedy, if any, is appropriate on a case-by-case, contract by contract, basis. For example, such contractor failure may result in (i) a breach for which the County determines it is appropriate to declare a contract default and thereafter take further action and/or remedy as deemed appropriate by the County in its sole discretion, or (ii) a contract breach upon which the County may elect take no further action if deemed appropriate by the County in its sole discretion, or (iii) if mutually agreeable to the County and the contractor, such revision shall be documented via a contract amendment, executed by legally authorized representatives of the County and the contractor as described below in "Approval Required for Changes", or (iv) other actions or remedies as deemed appropriate by the County. Each action and/or remedy described above is at the sole discretion of the County.

Cooperation in Reviews: The bidder will cooperate with the County in any reviews of the contractor's procedures and practices with respect to MBE or WBE firms, which the County may from time to time conduct in its sole discretion.

Approval Required for Changes: Any and all changes to the contractor's use of MBE/WBE subcontractors during the contract term must be mutually agreeable to the County and the contractor and shall be documented via a contract amendment, executed by legally authorized representatives of the County and the contractor.

Other: If the documents used to determine the contractor's efforts, achievement of, and/or the status of an MBE/WBE requirement or fulfillment thereof contain false, misleading or misrepresenting information, the contractor may be declared in breach of the contract and/or the County may take any and all actions and/or remedies available to the County under the contract, at law, or in equity. If an MBE/WBE is disqualified by any public entity, including but not limited to, Baltimore City, the State or MDOT, at any time after award or during the term of the contract, the County may, in its sole discretion, take any action or no action, as deemed appropriate by the County, including but not limited to, review of each situation on a case-by-case basis, require the prime contractor to promptly submit for County approval, the contractor's plans for fulfilling the required MBE/WBE participation under the contract, and/or request such detail and additional information as the County, in its discretion deems appropriate.

SPECIAL PROVISIONS
BIDDER PROTEST AND APPEAL
DPW CONSTRUCTION CONTRACTS

STEP 1A – Bidder Protest of Award
Bidder must file a written bid protest pursuant to Section GP-2.23 of the Standard Specifications – see below.
A bid protest must be in writing and filed with the Engineer.
Oral objections, whether or not acted on, are not protests.
(a) Time for Filing.
(1) A bid protest shall be filed not later than three (3) business days after the date of award.
(2) A protest based on alleged improprieties in the solicitation which are apparent before the bid opening or the closing date for receipt of initial proposals shall be filed not later than five (5) business days before the opening date.
(b) Content of Written Protest.
(1) Name and address of protestor.
(2) Bid or Contract number.
(3) Reasons for protest.
(4) Supporting exhibits, evidence or documents to support claim.

STEP 1B – Bidder Protest of Bid Rejection
Bidder must file a written bid protest with the Engineer not later than three (3) business days from the date of the bid rejection. Oral objections, whether or not acted on, are not protests. The written bid protest must comply with Section GP-2.23(b) of the Standard Specifications.

STEP 2 – DPW Response to Bidder Protest
The Department of Public Works (DPW), Chief of Division of Construction Contracts Administration will review the bidder's protest and respond to the bidder in writing within ten (10) working days of receipt of protest.

STEP 3 – Bidder Appeal
Bidder may appeal the decision by the Chief of Division of Construction Contracts Administration (a) to the Director of the Office of Budget & Finance for all MBE/WBE-related protests or (b) to the Director of Public Works for all other protests.

Bidder must file a written appeal with the relevant Director not later than three (3) business days from the date of the DPW Response in Step 2. Oral objections, whether or not acted on, are not appeals. The appeal must comply with Section GP-2.23(b) of the Standard Specifications, but may include any additional documentation as deemed necessary and appropriate by the bidder.

STEP 4 – Director Response to Bidder Appeal
The Director of the Office of Budget & Finance or the Director of Public Works will review the bidder's appeal and respond to the bidder in writing within fifteen (15) working days of receipt of appeal.

STEP 5 – Second Bidder Appeal
Bidder may appeal the decision by the Director of the Office of Budget & Finance or the Director of Public Works to the County Administrative Officer (CAO).

Bidder must file a written appeal with the CAO not later than three (3) business days from the date of the Director Response in Step 4. Oral objections, whether or not acted on, are not appeals. The appeal must comply with Section GP-2.23(b) of the Standard Specifications, but may include any additional documentation as deemed necessary and appropriate by the bidder.

STEP 6 – CAO Response to Bidder Appeal
The CAO, or his duly authorized designee, will review the bidder's appeal and respond to the bidder in writing within Twenty (20) Working days of receipt of appeal. The CAO's, or his duly authorized designee's, written decision is final and binding.

The Contract shall be done in strict compliance with the Baltimore County Department of Public Works February 2000 "Standard Specifications for Construction and Materials" and "Standard Details for Construction", and any and all revisions thereto as of the date of the fully executed Contract, including but not limited to the supplemental specification known as Addendum 3 and General Conditions Building Projects, as applicable, and all of which are made a part hereof and incorporated herein (collectively, the "Specifications"). Copies of the revisions are on file and available at the Division of Construction Contracts Administration, County Office Building, Towson, Maryland, and are on the County's website at http://www.baltimorecountymd.gov/Agencies/publicworks/standardsandspecs/specsanddetails.html. IN ADDITION, THE CONTRACTOR UNDERSTANDS AND AGREES THAT THE FOLLOWING SECTIONS OF THE SPECIFICATIONS (GP-1.03 AND GP-5-15) SHALL BE STRICKEN AND THE FOLLOWING SHALL BE INSERTED IN AND INCORPORATED INTO THE CONTRACT IN LIEU THEREOF:

GP-1.03 ORGANIZATIONAL DEFINITIONS

Administration - Baltimore County.

Administrator - The Director of the Office of Budget and Finance, Baltimore County.

Baltimore County - Baltimore County, Maryland: a body corporate and politic.

Department - The word "Department" shall mean the Office of Budget and Finance of Baltimore County.

Engineer - One of the following engineering executives:

Director of Office of Budget and Finance
Chief, Property Management Division of the Office of Budget and Finance

Any delegation of the Engineer's authority must be authorized in writing by any one of the above listed officials, and such delegation of authority will pertain only to the specific contract and/or contracts shown by the authorization. The title of the specific official will appear in those cases within these specifications where the word "Engineer" as defined herein is not sufficiently specific.

Inspector - The authorized representative of the procurement officer assigned to make detailed inspection of any or all portions of the work, or materials therefor.

Procurement Officer - See Engineer.

GP-5.15 DISPUTES

(a) Except as otherwise may be provided by applicable law or regulation, all disputes arising under or as a result of a breach of this Contract that are not disposed of by mutual agreement shall be resolved in accordance with this General Provision.

(b) As used herein, "claim" means a written demand or assertion by one of the parties seeking, as a legal right, the payment of money, adjustment or interpretation of Contract terms, or other relief, arising under or relating to this Contract.

A voucher, invoice, or request for payment that is not in dispute when submitted is not a claim under this General Provision. However, if the submission subsequently is not acted upon in a reasonable time, or is disputed either as to liability or amount, it may be converted to a claim for the purpose of this General Provision.

(c) When a claim cannot be resolved by mutual agreement, the Contractor shall submit a written request for decision to the Department's Chief of the Property Management Division for his decision in consultation with the County Office of Law. The Contractor's written request shall set forth all the facts surrounding the controversy, including, but not limited to, those items listed in GP-5.14(b). Any claim by the County shall be decided in like manner.

(d) The Contractor, at the discretion of the Engineer, may be afforded an opportunity to be heard and to offer evidence in support of his claim. Pending resolution of a claim, the Contractor shall proceed diligently with the performance of the Contract.

(e) The Department's Chief of the Property Management Division shall decide any and all claims. The decision by the Department's Chief of the Property Management Division shall be issued within ninety (90) Days on matters of less than fifty thousand dollars ($50,000) and within one hundred eighty (180) Days on matters of fifty thousand dollars ($50,000) or more. The written decision of the Department's Chief of the Property Management Division shall be final and binding unless appealed in writing to the Director of the Department within thirty (30) Days of the Chief's written opinion to the parties. If the Chief's decision is timely appealed in writing to the Director of the Department, the Director of the Department, serving as referee, will review the written appeal submitted to assure all reasonable attempts were made to resolve the appeal.

(f) The Director shall issue his/her decision in writing within ninety (90) Days. The Director's decision shall be final and conclusive unless a written appeal is mailed or otherwise filed with the County Administrative Officer within thirty (30) Days of the Director's written decision.

(g) When the County Administrative Officer is satisfied all efforts at the Department level were made to resolve the dispute, a claim shall be resolved as follows:

(1) Subject to, and without in any way enlarging or limiting the other provisions of the Contract, the parties to any Agreement which adopts or incorporates by reference these Standard Specifications, appoint the County Administrative Officer as an administrative hearing officer pursuant to Article 25A, "Chartered Counties of Maryland", of the Annotated Code of Maryland.

(2) The parties further grant the County Administrative Officer the right to delegate this responsibility and authority in writing to a County official who is a registered professional engineer, independent of the Department of Public Works's Division of Construction Contracts Administration, or to any other County official.

(3) For disputes involving ten thousand dollars ($10,000) or more the decision of the administrative hearing officer shall be final and binding on both parties, subject only to such appeals on the record as provided by Article 25A. For disputes involving less than ten thousand dollars ($10,000), the decision of the administrative hearing officer shall be final and binding on both parties.

GENERAL CONDITIONS

BUILDING PROJECTS

Revised March 2001, June 2005,
March 2010 and February 2014
in compliance with February 2000
Standard Specifications for Construction & Materials

INDEX GENERAL CONDITIONS
BUILDING PROJECTS

VII. LAWS, PERMITS, LICENSES, INSURANCE & BONDS

VIII. INSPECTION AND SURVEYS

IX. CONSTRUCTION

X. MISCELLANEOUS ADDENDA

GENERAL CONDITIONS
DESIGN BUILD BUILDING PROJECTS

I. SPECIFICATIONS

Article 1 Applicable Specifications

All work performed under this Contract shall be done under strict compliance with the *Specifications* bound herewith, and with the *Baltimore County Standard Specifications for Construction and Materials* and the *Standard Details for Construction* dated February 2000 and subsequent addenda thereto, so far as the same may be applicable, copy of which is on file in the Baltimore County Department of Public Works. These General Conditions are in addition to the aforementioned Specifications. Should there be any conflict with the aforementioned manuals, the *General Conditions* take preference.

II. DEFINITIONS

Article 2 Definitions

A. *Architect and/or Engineer* shall mean the registered Architect and/or Engineer commissioned by the County to prepare the plans and contract documents.

B. *Engineer* in these General Conditions and in the Construction Specifications in some instances refers to authorized representatives of the Office of Budget and Finance, Property Management.

C. *Subcontractor*, as employed herein, includes only those having a direct contract with the Contractor. It includes one who furnished material worked to a special design according to the Plans and Specifications for the "work." It excludes one who merely furnished material not so worked.

D. *Written Notice* shall be deemed to have been duly served if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered to or sent by registered mail to the last business address known to him who gives the notice.

E. *Repair* means to restore after injury, deterioration, or wear; to mend, to renovate, by such means as appropriate, and to supply such materials and labor as necessary to render the item to be repaired sound, solid, true, plumb, square, even, smooth, and fully serviceable. Upon completion of such repair it must be, unless otherwise stated, rendered to such condition as to present a first-class finished work, or in instances where the repaired item serves as a base for additional finish, the repaired work must be such as to permit a first-class finish, to be applied without extra cost to the County. When the word "repair" is used in connection with machinery or mechanical equipment, it shall mean, in addition to the above, rendering the equipment completely serviceable and efficient, ready for the normal use for which it was originally intended.

F. Some parts of the "Construction Specifications," bound herewith are of the abbreviated or "streamlined" type and includes incomplete sentences. Omissions of words or phrases such as "the Contractor shall", "in conformity therewith", "shall be", "as noted on the drawings", "according to the plans", "a", "an", "the", and "all" are intentional. Omitted words or phrases shall be supplied by inference in the same manner as they are when a "note" occurs on the drawings. Words "shall be" or "shall" will be supplied by inference when colon (:) is used within sentences or phrases.

Article 3 Time Limits

The proposal shall indicate whether the contract limit is based on Working Days or Calendar Days. If this is not indicated in the Proposal, then the time limits will be based on Calendar Days.

Article 4 Sunday, Night and Holiday Work

If Sunday, night or holiday work is necessary due to an emergency or is permitted by the Engineer, the Contractor shall secure and pay for any and all permits required in connection with this work.

III. CONTRACT DOCUMENTS AND SHOP DRAWINGS

Article 5 Contract Documents

A. Clarification

It is assumed that the Contractor has obtained clarification of all questions which may have arisen as to intent of the contract documents, or assumed, or actual conflict between two or more items in the Contract Documents as required in "Instructions to Bidders." Should the Contractor have failed to obtain such clarification as required by the "Instructions to Bidders," then the Engineer may direct the work to proceed by any method indicated, specified or required by the Contract Documents in the interest of maintaining the best construction practice. Such direction by the Engineer shall not constitute a claim for extra by the Contractor.

B. Jargon

Work described in words that have a well-known technical or trade meaning shall be held to refer to such recognized standard use.

C. Drawings

The Contractor shall do no work without proper drawings and instructions. Drawings are, in general, drawn to scale; however, symbols are used to indicate materials and structural and mechanical requirements. When symbols are used, the drawings are, of necessity, diagrammatic, as it is not possible to indicate all connections, fittings, fastenings, etc., which are included as a part of the work. Diagrammatic indication of mechanical piping, ducts, and conduit within the buildings is subject to adjustment in order to obtain proper grading, passage over, under or past obstructions, to avoid exposure in finished rooms and unsightly and obstructing conditions. The Contractor shall coordinate these adjustments.

1. Copies Furnished

The county will furnish the Contractor, without cost, fifteen (15) copies of Drawings and Specifications. Additional copies may be obtained by the Contractor upon payment of the cost of the reproduction of the drawings.

2. Copies of the Work

The Contractor shall keep in the office on the job a complete set of all drawings, specifications, shop drawings, schedules, etc., in good order and available to the Engineer and representatives of the County.

3. Ownership

All documents as furnished by the County remain the property of the County. They must not be used on other work but shall be returned to the County upon completion of the work.

D. Large Scale Detail Drawings

The Architect shall furnish, when necessary, additional instructions in the form of large scale developments of the drawings used for bidding, or to amplify Construction Specifications for the proper execution of the work. These shall be true developments of the bidding documents and reasonably inferable there from. The work shall be executed in conformity herewith. [See Article 6, Paragraph A.3.(c)]

E. Dimensions

The Contractor shall carefully check all dimensions prior to execution of the particular work affected. Whenever inaccuracies or discrepancies are found, the Contractor shall consult the Engineer prior to any construction or demolition. Should any dimensions be missing, the Engineer will be consulted and supply them prior to execution of the work. Dimensions for items to be fitted into constructed conditions at the job will be taken at the job and will be the responsibility of the Contractor. The obvious intent of the documents or obvious requirements dictated by conditions existing or being constructed supersedes dimensions or notes which may be in conflict herewith.

Whenever a stock size manufactured item or piece of equipment is specified by its nominal size, it is the responsibility of the Contractor to determine the actual space requirements for setting or entrance to the setting space. No extra will be allowed by reason of work requiring adjustment in order to accommodate the particular item of equipment.

Whenever new work, building, addition or portions thereof are not accurately located by plan dimensions, the Engineer will supply exact position prior to execution of the work.

Article 6 Shop Drawings

A. Shop Drawings (those prepared by the Contractor or Vendor of Material)

The Contractor shall submit for the Architect's approval, at such times as agreed (see Article 8), shop drawings (to include setting drawings and schedules) as required for the work of the various trades. These drawings shall be prepared in conformity with the best practice and standards for the trade concerned. Due regard shall be given to speed and economy of fabrication and erection.

1. Items to be Detailed

Shop details shall be supplied for all items which are specially fabricated for the work or when the assembly of several items is required of a working unit. Shop drawings are required for all reinforcing and structural steel, specially made or cut masonry units, miscellaneous metal work, specially made flashings or roofing and sheet metal work, specially made millwork, special rough hardware and all heating, ventilating, plumbing and electrical requiring special fabrication or detailed connections, including ducts.

2. Submissions

Shop drawings, brochures and catalog cut submissions shall consist of sufficient copies to provide for the retention by the Architect and County of five (5) copies total plus such additional copies as the Contractor may require. Drawings shall not exceed 24 in. x 36 in. in size.

3. Examination and Approval

The Contractor shall review all shop drawings, brochures and catalog cuts provided by the subcontractors and vendors prior to submitting them to the Architect. The Architect shall examine shop drawings with reasonable promptness, noting desired corrections, or granting approval.

a. Field Dimensions and Conditions

The Architect is not responsible for the checking of dimensions or existing conditions in the field. This is the sole responsibility of the Contractor.

b. Resubmission

When the Architect's notations or corrections are extensive, then the Contractor shall resubmit the drawings with changes made on the drawings.

c. Contractor's Responsibility

Unless the Contractor has in writing, notified the Architect to the contrary, at the time of submission, it will be assumed that the drawings are in conformity with the Contract Documents and do not involve any change in the Contract price or any change which will alter the space within the structure or alter the manner of operation from that contemplated in the Contract Documents.

d. Architect's Notations

Should the Contractor consider any change or notation received in compliance with paragraph (c) above as increasing the cost of the work from that contemplated in the Contract Documents, then the Contractor shall desist from further action relative to the item he/she questions and shall notify the Engineer, in writing, within five (5) days of the additional cost involved. No work shall be executed until the entire matter is cleared or a Change Order issued, or the Contractor is ordered by the Engineer to proceed under the provisions of the County's Standard Specifications. Failure of the Contractor to serve written notice, as above required, shall constitute a waiver of any claim in relation thereto.

(1) Similarly, should the Architect's notation or change involve less work than is covered by the Contract Documents, the Contractor shall allow the County the credit resulting from the change.

(2) Should the Contractor consider that any notation or change made by the Architect under provisions of this paragraph, paragraph (c), above, as involving a complete change in the subcontractor's relation or the substitution of a material different from that on which the Contract was based, then the Contractor shall act as herein stated or as in paragraph (c) above.

4. Project Completion

At the completion of the project, the Contractor shall submit a list of shop drawings for the entire project. This list shall contain the following information: title, description, specialty (Architectural, Structural, Mechanical, etc.), decision (no exceptions taken, approved, approved as noted, etc.).

Article 7 Separate Contracts

A. The County reserves the right to let other contracts in connection with paving and utilities adjoining this work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work, and shall properly connect and coordinate his work with theirs.

B. If any part of the Contractor's work depends for proper execution or results upon the work of any other contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such work that render it unsuitable for such proper execution and results. Failure to inspect and report shall constitute an acceptance of the other contractor's work as fit and proper for the reception of the work, except as to the defects which may develop in the other contractor's work after the execution of the work.

C. To ensure the proper execution of his/her subsequent work, the Contractor shall verify work already in place and shall at once report to the Engineer any discrepancy between the executed work and the drawings.

IV. PAYMENTS

Article 8 Payments

A. Under this Contract payments will be made monthly on the valuation of work accomplished and on account of materials delivered on the site, for incorporation in the work, which are suitably stored.

B. At the first of each month, the Contractor shall submit to the Engineer an application for payment on a form provided by the Engineer. Prior to application for first payment, the Contractor shall submit to the Engineer a schedule of values for the various parts of the work, including quantities, aggregating to the total sum of the Contract. This shall be so divided as to facilitate payment to subcontractors in accordance with Article 28, Paragraph C.1. The form of this submission shall be such as the Contractor or Engineer have agreed upon, and, if required, shall be supported by such evidence as to its correctness as the engineer may direct. This schedule, when approved by the Engineer, shall be used as a basis for approval of payment unless it is found to be in error. In applying for payment, the Contractor shall submit a statement based upon the schedule, itemized in such form and supported by such evidence as the Engineer may require, showing the Contractor's right to the payment claimed. If required, the Contractor shall show receipts and other vouchers for the payments for materials and labor including payments to subcontractors, as required by Article 28.

C. Materials Purchased Under Allowance

The Engineer will provide schedules for all materials to be purchased from specified allowance.

Article 9 Approval of Payments

If the Contractor has made application, as above, the Engineer shall review and approve such payments as is decided to be properly due in accordance with the approved schedule. In approving such partial payments, there shall be retained no more than 10% of the total amount for the first 50% of the contract, after which only 5% of the total amount of the contract may be withheld unless the need is demonstrated for retaining more to protect the public interest.

Article 10 Payment Withheld

A. The Engineer may withhold, or on account of subsequently discovered evidence, nullify the whole or a part of any payment to such extent as may be necessary to protect the County from loss on account of:

1. Defective work not remedied.

2. Claims filed, or reasonable evidence indicating probable filing of claims, by parties other than the Contractor.

3. Failure of the Contractor to make payments properly to subcontractors or for material or labor.

4. A reasonable doubt that the Contract can be completed for the balance then unpaid.

5. Damage to another Contractor.

6. Failure of the Contractor to submit data required within the time limits stated in the Contract Documents.

Upon removal of the above, payment shall be made for the amounts withheld.

Article 11 Changes in Work

A. The County, without invalidating the Contract, may order changes in the work by altering, adding to or deduction from the work, the Contract sum being adjusted accordingly. Such change shall be executed under these *General Conditions*. Extension of time made necessary thereby shall be adjusted at the time of such Change Order.

B. The Engineer shall have authority to make minor changes in the work not involving extra cost and not inconsistent with the purpose of the project. Otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless a written order for the Office Budget and Finance, Property Management signed or countersigned by the Director has been received by the Contractor. No claim for addition to the Contract sum shall be valid unless so ordered.

C. The value of any such extra work or change shall be determined in one or more of the following ways as determined by the Office of Budget and Finance, Property Management.

1. By Estimate and Acceptance of a Lump Sum

a. The prime Contractor shall furnish a breakdown of the estimated construction cost. The breakdown shall be of sufficient detail to describe the extra work and related costs for labor, material, overhead and profit.

b. Overhead and Profit

(1) Extra work by Subcontractor:

Subcontractor will be allowed 10% overhead and 10% profit added to the direct labor and material costs. The prime contractor will be allowed to increase the subcontractors total lump sum by 10% to cover his/her administration.

(2) Extra work by Prime Contractor:

The prime contractor will be allowed 10% overhead and 10% profit added to the labor and material costs.

c. The prime contractor will be allowed 1% for the bond added to the labor and material costs.

d. The allowed overhead will include all supervision; no additional allowance will be made for it.

2. By Unit Prices Named in the Contract or Subsequently Agreed Upon

Such unit prices are to include all supervision, overhead, taxes, insurance and profit.

3. By Cost and a Fixed Fee

Added to the cost is a fixed fee portion which is to include supervision, overhead, insurance and profit.

4. By Force Account (Labor and Material Cost plus)

In accordance with the *Baltimore County Specifications for Construction and Materials* Section GP 9.02, the Contractor is allowed to add 65% mark-up.

D. Should none of the methods stated in Paragraph C. 1, 2, or 3 be determined, the Contractor shall, providing he/she receives an order as defined in Paragraph B, above, proceed with the work on the basis of Paragraph C. 4. Force Account.

The Contractor and Engineer shall keep accurate costs, in such form as the Engineer may direct, for presentation, together with vouchers, to the Office of Budget and Finance Property Management for determination of the value of the work included in each Change Order. Pending determination of the final value, the Engineer may include payments for materials and labor, as stated in Article 8, in monthly vouchers.

Article 12 Claims for Extra Cost

No claim for extra will be granted which includes cost of delays or work stoppage due to strikes, lockouts, fire, avoidable casualties or damage or delay in transportation for which the County or its agents are not responsible. (See also Article 14.)

Article 13 Deductions for Uncorrected Work

If the Engineer and County deem it expedient to correct work injured or done not in accordance with the Contract, an equitable deduction from the Contract price shall be made therefore.

Article 14 Delays and Extension of Time

If no schedule or agreement stating the dates upon which drawings shall be furnished is made (see Article 8), then no claim for delay shall be allowed on account of failure to furnish drawings until two (2) weeks after demand for such drawings, and then not unless such claim is reasonable.

Article 15 Correction of Work After Final Payment

Neither the final certificate nor payment nor any provision in the Contract Documents shall relieve the Contractor of responsibility for faulty materials and workmanship. Unless otherwise specified, the Contractor shall remedy any defects and pay for any damage to other work resulting there from that appears within the guarantee period. The County shall give notice of observed defects with reasonable promptness. All questions arising under this Article shall be decided by the Director of Budget and Finance, Property Management.

Article 16 (Deleted)

Article 17 Assignment

The Contractor shall not assign the Contract. It shall not be sublet as a whole or sublet by trades or other portions in an amount of more than 75% of the monetary value of the Contract. The remaining 25% shall be executed by the Contractor with labor and materials directly purchased and paid for by the Contractor. Costs for insurance, over-head, supervisions, etc., may not be claimed as a portion of the 25% mentioned above. The execution of work by a subsidiary of the Contractor is not considered direct employment. The Contractor shall not assign any monies due or to become due to him/her hereunder, without the previous written consent of the County.

Article 18 Maryland State Sales Tax

A. Contractors who are performing work for the State of Maryland or any of its political subdivisions are required to pay tax on materials and supplies which will be incorporated into the work.

B. The Contractor must pay the tax on all equipment which is purchased, even though it may be used on a job for the State of any of its political subdivisions.

V. MATERIALS

Article 19 Materials

Materials include all manufactured products and processed and unprocessed natural substances required for completion of the Contract. The Contractor in accepting the Contract is assumed to be thoroughly familiar with the materials required and their limitations as to use and requirements for connections, setting, maintenance and operation.

Whenever an article, material or equipment is specified and a fastening, furring, connection (including utility connections), bed or accessory is normally considered essential to its installation in good quality construction, such shall be included as if fully specified. Nothing in the Construction Specifications shall be interpreted as authorizing any work in any manner contrary to applicable law, codes or regulations (See Article 31).

A. Approval

All materials are subject to the Architect's or Engineer's approval as to conformity with the specifications, quality, design, color, etc. No work for which approval is necessary shall be contracted for, or used, until written approval is given by the Architect or Engineer. Approval of a subcontractor, as such, does not constitute approval of a material which is other than that included in the Construction Specifications.

B. New Materials

Unless otherwise specified, all materials shall be new.

C. Quality

Unless otherwise specified, all material shall be of the best quality of the respective kinds.

D. Samples

The Contractor shall furnish for approval all samples as directed. The work shall be the same as the approved samples.

E. Painting and Color

The Architect and Contractor shall jointly prepare the paint and color schedules. The Architect shall direct the exact color, texture and finish.

F. Proof of Quality

The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials either before or after installation. The Contractor shall pay for any tests as may be deemed necessary in relation to "Substitutions" (Paragraph I. below).

G. Contractor's Option

When several products or manufacturers are named in the Construction Specifications for the same purpose or use, then the Contractor shall select any of those so named. However, all of the units of a thing required for a project must be the same in material and manufacture.

H. "Or Equal", "Equal", "Approved Equal"

The above terms are used as synonyms throughout the Construction Specifications. They are implied in reference to all named manufacturers. Only materials that, in the opinion of the Engineer, are fully equal in all details of construction, methods of assembly, finish and design quality will be considered. (See A, C, E, above, and I. below.)

I. Substitutions

Should the Contractor desire to substitute another material for one or more specified by name, the Contractor shall apply, in writing, for such permission and state the credit or extra involved by the use of such material. The Engineer will not consider the substitution of any material different in type or construction methods unless such substitution effects a benefit to the County. (See A. and D. above.)

The Contractor shall not submit for approval, materials other than those specified without a written statement why such a Substitution is proposed. Approval of a "substitute" material by the Architect or Engineer when the Contractor has not designated such material is a "substitute," shall not be binding on the County nor release the Contractor from any obligations of the Contract, unless the Architect or Engineer approves such "substitutions" in writing.

J. Standard Specifications

Whenever references are made in the Contract Documents to the *Baltimore County Standard Specifications for Construction and Materials* and *Standard Details for Construction*, it shall be understood that the latest standards and/or requirements are intended and shall apply. When no specification is cited and the quality, processing, composition or method of installation of a thing is only generally referred to then:

1. For things not otherwise specified below, the latest edition of the Applicable American Society for Testing Materials Specifications shall apply.

2. For things covered by the applicable portions, the National Bureau of Fire Underwriters Code shall apply.

3. For things generally considered as plumbing and those things requiring plumbing connections, the applicable portions of the latest edition of the American Society of Mechanical Engineers Code and the Baltimore County Plumbing Code shall apply.

4. For things generally considered as heating and ventilating work and not covered by A.S.M.E. Code, the applicable portions of the latest edition of the Heating and Ventilating Guide, published by the American Society of Heating and Ventilating Engineers, and the Baltimore County Building Code shall apply.

K. Storage

The contractor shall confine apparatus and storage of materials to the "off-road" area delineated as the "Limit of Contract." The Contractor shall not load or permit any part of the structure to be loaded with a weight that will endanger the safety of the structure or any part thereof.

VI. QUALIFICATION, EMPLOYEES, WORKMANSHIP, SUBCONTRACTORS AND ADVERTISING

Article 20 Qualification of Bidders

Bidders are required to be prequalified 10 days prior to bid opening, satisfactorily evidencing that they have the ability, equipment, organization and financial resources sufficient to enable completion of the work satisfactorily within the time specified in the Proposal.

Article 21 Employees and Workmanship

A. Employees

1. Qualification

Only personnel thoroughly trained and skilled in the task assigned them may be employed on any portion of the work, or they shall be removed.

2. Licensed

When County, State or Federal laws require that certain personnel (electricians, plumbers, etc.) be licensed, then all such personnel employed on the work shall be so licensed.

B. Quality of Labor

The Contractor shall employ on the work, at all times, sufficient personnel to complete the work within the time stated in the Proposal.

C. Work Areas

The Contractor shall confine the operations of his/her employees to the limits as provided by law, ordinance, permits or directions of the Office of Budget and Finance Property Management. Generally, the "off-road" area will be the same as the "limit of Contract" line.

D. Methods and Quality

1. All workmanship shall be of good quality. Whenever the method of the work or manner of procedure is not specifically stated or shown in the Contract Documents, then it is intended that the best standard practice shall be adhered to. Recommendations of the manufacturers of approved materials shall be considered as a part of Construction Specifications and all materials shall be applied, installed, connected, erected, used, cleaned and conditioned as so called for thereby. This, however, does not remove any requirement in Construction Specifications to add to the manufacturer's recommendations.

2. All materials shall be accurately assembled, set, etc., and when so required in good construction, shall be true to line, even, square, plumb, level and regularly spaced, coursed, etc. Under no circumstances, either in new or old work, shall any material be applied over another which has not been thoroughly cleaned, sanded or otherwise treated so as not to impair the finish, adhesion, or efficiency of the next applied item.

3. All methods, procedures and results are subject to the Engineer's approval as to finished result to be obtained. However, this is not to be interpreted as placing upon the Engineer any responsibility for the "work" management which is solely the responsibility of the Contractor.

E. Joining of Work

1. The Contractor shall so schedule the work as to ensure efficient and uninterrupted progress and to hold to an absolute minimum the cutting and patching of new work. All cutting, patching and digging necessary to the execution of the work is included.

2. The Contractor shall so schedule (to include subcontracts) the construction performed by each group or trade that each installation or portion of the construction shall member with and join with all other work as required for a complete installation, all according to accepted good construction practice.

F. Superintendent

The Contractor shall keep on the work, at all times during its progress, a competent superintendent and all necessary assistants, all approved by the

Office of Budget and Finance Property Management. Prior to commencement of the work, the Contractor shall submit in writing to the Office of Budget and Finance Property Management the name and qualifications of the person to be employed as Superintendent for the execution of the Contract. A written approval or rejection will be given following review of the data. Persons who have previously proved unsatisfactory on work executed for the County, or who are without proper qualifications, will not be approved. Should the Superintendent be complained of by the Office of Budget and Finance Property Management for cause, he/she shall be removed from the work. Should it be necessary to change the Superintendent, the above procedure shall be repeated. The Superintendent will represent the Contractor. All directions given to the Superintendent shall be as binding as if given to the Contractor. Important directions shall be confirmed on written request in each case.

G. Discipline

The Contractor shall at all times enforce strict discipline and good order among his/her employees and shall not employ or permit to remain on the work any unfit person. The Contractor shall enforce all instructions relative to use of water, heat, power, no smoking, and control any use of fires, as required by law and for the Office of Budget and Finance Property Management. Employees must not be allowed to loiter on the premises before or after job working hours.

Article 22 Employment Lists

The Contractor may contact MARYLAND STATE EMPLOYMENT SERVICE, Towson, MD, 21204, if so desired, for additional labor regarding this project.

Article 23 Contractor's Supervision (Also see Article 21, Paragraph F.)

The Contractor shall constantly maintain efficient supervision of the work, using his/her best skills and coordinating ability. The Contractor shall carefully study and compare all drawings, specifications, and other instructions and check them against conditions existing or being constructed on the project. The Contractor shall report to the Engineer any error inconsistency or omission which may be discovered. (See also Article 5, Paragraph E, and Instructions to Bidders.) The Contractor shall not be held responsible for the existence or discovery of such errors or conflicts and neither shall the adjustment of such errors or conflicts be grounds for claim for extra on the art of the Contractor unless such adjustment involves work not obviously contemplated by the Contract Documents or necessary to progress of the work. The Contractor shall be responsible for the coordination of the work of all subcontractors.

Article 24 The County's Right to do Work

If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the County after three days' written notice to the Contractor may, without prejudice to any other remedy, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor.

Article 25 County's Right to Terminate Contract

A. Terminate Contract

The Office of Budget and Finance, Property Management, upon proof that sufficient cause exists to satisfy such action, may without prejudice to any other right or remedy, and after giving the Contractor seven (7) days' written notice, terminate the employment of the Contractor and take possession of the premises and of all materials, tools, and appliances thereon and finish the work by whatever method may be deemed expedient, if any of the following conditions exists:

1. If the contractor should

   a. Be adjudged a bankrupt or make a general assignment for the benefit of creditors,

   b. Has a receiver appointed on account of insolvency.

   c. Fails to or repeatedly and persistently refuses to supply properly skilled workers or proper materials, except in cases for which extension of time is provided,

   d. Fails to make payment to subcontractors, or for materials and labor,

   e. Persistently disregards laws, ordinances or the instructions of the Engineer, or

   f. Is otherwise guilty of a substantial violation of any provision of the Contract.

2. Payment Status

   In cases such as identified above, the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the Contract price shall exceed the expenses of finishing the work, including compensation for additional managerial and administrative services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the contractor shall pay the difference to the County. The expense incurred by the County as herein provided, and the damage incurred through the Contractor's default, shall be itemized by the Engineer and a certified copy supplied to the Contractor.

Article 26 Sanitary Conveniences

A. The Contractor shall arrange for the erection and Maintenance of temporary toilets equipped with running water and drain connection for use of employees. These conveniences shall be erected and kept clean and in good condition, as required by law, until ordered removed by the Engineer.

B. In lieu of A. above, the Contractor may install a portable approved chemical toilet at an approved location.

C. The permanent plumbing fixtures to be constructed under this Contract shall not be used during construction, under any circumstances.

Article 27 Subcontracts Deleted

Article 28 Relation of Contractor and Subcontractor

A. **The Contractor agrees** to bind every subcontractor and every subcontractor agrees to be bound by the terms of the Agreement, *Baltimore County's Standard Specifications for Construction and Materials* and *Standard Details for Construction* the *General Conditions,* the Drawings and Construction Specifications, as far as applicable, to his/her work, including the following provisions of this Article, unless specifically noted to the contrary in the subcontract approved in writing as adequate by the Office of Budget and Finance, Property Management.

B. **The Subcontractor agrees** to be bound to the Contractor by the terms of the Agreement, *Baltimore County's Standard Specifications for Construction and Materials* and *Standard Details for Construction, General Conditions,* Special Provisions, Construction Specifications, and to assume towards him/her all obligations and responsibilities that he/she, by those documents, assumes towards the County.

1. To submit to the Contractor applications for payment in such reasonable times as to enable the Contractor to apply for payment under Article 8 of these *General Conditions.*

2. To make all claims for extras, for extensions of time and for damages for delays or otherwise, to the Contractor in the manner provided in *Baltimore County's Standard Specifications for Construction and Materials* or those *General Conditions* for like claims by the Contractor upon the County, except that the time for making claims for extra cost is one (1) week.

C. **The Contractor agrees** to be bound to the Subcontractor by all the obligations the County assumes to the Contractor under Agreement, *Baltimore County's Standard Specifications for Construction and Materials, General Conditions,* Drawings and Construction Specifications, and by all the provisions thereof affording remedies and redress to the Contractor from the County.

1. To pay the Subcontractors:

   a. Upon receipt of payment, if issued under the schedule of values described in *Baltimore County's Standard Specifications for Construction and Materials,* G.P.-9.03 or Article 8 of these *General Conditions,* the amount allowed to the Contractor on account of the Subcontractor's work, to the extent of the Subcontractor's interest herein.

   b. Upon the receipt of payment, if issued otherwise than as in Paragraph C.1., above, so that at all times the total payments shall be as large in proportion to the value of the work done by him as the total amount certified to the Contractor is to the value of the work done by him/her.

   c. To such extent as may be provided by the Contract Documents or the subcontract, if either of these provides for earlier or larger payments than the above.

   d. On demand for his/her work or materials as far as executed and fixed in place, less the retained percentage, at the time the payment is requested, even though the Engineer fails to approve it for any cause not the fault of the Subcontractor.

   e. A just share of any fire insurance money received by him/her, the Contractor, under Article 35 of these *General Conditions.*

2. To make no demand for liquidated damages or penalty for delay in any sum in excess of such amount as may be specified in the subcontract.

3. That no claim for services rendered or materials furnished by the Contractor to the Subcontractor shall be valid unless written notice thereof is given by the Contractor to the Subcontractor during the first ten (10) days of the calendar month following that in which the claim was originated.

4. To give the Subcontractor an opportunity to be present and to submit evidence in any manner involving his/her rights.

5. The Contractor and the Subcontractor agree that nothing in this Article shall create any obligation on the part of the County to pay to or to see to the payment of any sums to any Subcontractor.

Article 29 Interlocking Contracts

The attention of the Contractor and all Subcontractors is specifically called to the necessity of reading the Specifications covering items of the work which connect with or are dependent upon the work specified under each heading, and each Contractor executing the work called for there under shall be responsible for arranging for proper provision for connecting and coordinating his/her work with such other items.

Article 30 Advertising Signs

A. The Contractor will furnish, erect and maintain a project sign for the duration of the project. The sign shall be placed on the site where and as directed by the Engineer. The sign shall be fastened to three posts spaced 4' apart. The posts shall be 4" x4", seven feet above ground and three feet below ground.

B. The project sign is shown on page GC-27 in this book.

VII. LAWS, PERMITS, LICENSES, INSURANCE, AND BONDS

Article 31 Laws, Permits and Regulations

A. Permit and Service Connections:

1. **BUILDING PERMIT** – The County will obtain the building permit at no cost to the Contractor.

2. **PERMANENT WATER SERVICE** – The County will apply for the water service and pay all related charges; i.e., water meter, water systems connection charge, water distribution charge and sewer systems connection charge. Total installation of the permanent water service is part of this Contract. Water service shall be installed by a County Prequalified Utility Contractor.

3. **PLUMBING PERMIT** – The Contractor shall apply for the Permit; however, the County will pay all related charges and fees.

4. **PERMANENT ELECTRIC SERVICE** – The Contractor shall apply for and pay for the electrical permit. The County shall obtain BGE permanent gas and electric service to the site at no cost to the Contractor.

   The Contractor shall coordinate the installation of permanent gas and electric service with Baltimore Gas & Electric

Company. Both the gas and electric services shall be activated at the same time under one account number showing Baltimore County as owner. The Contractor shall be responsible for payment of consumption charges for the use of gas and electric energy obtained through the permanent service until the building is accepted by the County or until agreed upon by the County in direct coordination with the Building Services Division of Baltimore County. Charges from BGE for removal of existing electric service will be paid by the County.

5. **PERMANENT TELEPHONE SERVICE** – The County shall pay for the telephone service and systems to and in the building. The Contractor is responsible for supplying and installing all conduit, cables and junction boxes as shown on the drawings or called out in the Specifications.

6. **CABLE** – The County shall pay for any cable television service into the building. The contractor is responsible for supplying and installing the remaining work as shown on the drawings and called out in the Specifications.

7. **TEMPORARY SERVICES** – All temporary services, such as water, electric, telephone, etc., shall be the Contractor's entire responsibility. (Also see Article 46.)

8. **MISCELLANEOUS PERMITS** - The Contractor shall procure any and all necessary permits not previously mentioned and pay any and all related charges and fees required and incidental to the due and lawful prosecution of the work.

B. The Contractor shall give all notices and comply with all State and Federal laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the Drawing and Contract Specifications are at variance therewith, he/she shall promptly notify the Engineer, in writing, and any necessary changes shall be adjusted as provided in the Contract for changes in the work. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Engineer, he/she shall bear all costs arising there from.

Article 32 Compensation, Liability, and Property Damage Insurance

(See Insurance Provision in Part VI of this Contract.)

Article 33 Builder's Risk Insurance

A. The Contractor shall, at his/her own cost, insure the work and keep it insured at all times during the period of construction, and until final acceptance of it by the County, against loss or damage covered by

an "All Risk" Builders Risk type of policy. The amount of insurance shall be the 100% estimated replacement cost of the work.

B. The policies shall be made payable to the County and the Contractor, as their interest may appear, and the policies shall be left in the possession of the Engineer, prior to the start of construction.

Article 34 Guaranty Bonds

A. Prior to signing of the Contract, the Contractor will be required to furnish bond covering the faithful performance of the Contract and the payment of all obligations arising there under, in such form as the County may prescribe with such sureties as the County may approve. The premiums shall be paid by the Contractor.

B. The Bond to be in the amount of the total Contract price.

C. At the direction of the Office of Budget and Finance, Property Management, the Contractor may be required to increase the above bond. Such addition will be paid for by the County in the amount of actual cost to the Contractor.

Article 35 Damages

A. If either party to this Contract should suffer damages in any manner because of the wrongful act or neglect of the other party or of anyone employed by him/her, then reimbursement shall be made by the other party for such damage.

B. Claims under this clause shall be made in writing to the party liable within a reasonable time at the first observance of such damage and not later than the time of final payment, except as expressly stipulated otherwise in the case of faulty work or materials, and shall be adjusted by agreement.

C. Should the Contractor cause damage to any separate contractor on the work, the Contractor agrees, upon due notice, to settle with such contractor by agreement or refer the matter to the Office of Budget and Finance, Property Management, who will render a decision after hearing all evidence in the matter. The Contractor shall pay or satisfy such decision.

VIII. INSPECTION AND SURVEYS

Article 36 Inspection

A. If the Construction Specifications, the Engineer's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give the Engineer timely notice of its readiness for inspection, and if the inspection is by another authority, the date fixed for such inspection. Inspections by

the Engineer shall be made promptly, and where practicable, at the source of supply. Any work covered without approval of the Engineer must, if required, be uncovered for examination at the Contractor's expense.

B. If initial tests and/or inspections show substandard products, materials, workmanship, etc. and the Contractor elects, with the Engineer's approval, to perform additional tests and/or inspections to prove the acceptability of the substandard products, materials, workmanship etc., he/she shall perform same at his/her expense.

Article 37 Surveys

A. The General Contractor shall, at his/her own expense, employ a registered surveyor to provide Elevation Bench Mark, and locate corners of the building and the limits of contract.

B. The General Contractor shall, at his/her own expense, employ a competent field engineer, to give the lines and levels for the building, sidewalks and footings, etc. The Contractor will be responsible for all lines and levels and will guarantee all lines and levels as are shown on drawings.

Article 38 Unauthorized Work

Work done without lines and grades being established, work done beyond the lines and grades shown on the Plans or as established, except as herein provided, or any extra work done without written authority will be considered as unauthorized and at the expense of the Contractor and will not be measured by the Engineer, or paid for by the County. Work so done may be ordered by the Engineer to be removed and replaced at the Contractor's expense.

IX. CONSTRUCTION

Article 39 Construction Schedule

The Contractor shall hold bi-weekly "progress meetings" at the site, at a time suitable to the Engineer, at which the progress of the work shall be reported upon in detail with reference to schedules. Each interested subcontractor shall be required to have present a competent representative to report the condition of his/her branch of the work and to receive instructions. Minutes of these "progress meetings" shall be taken by the Contractor who shall type them for distribution to members of the conference, the Office of Budget and Finance, Property Management, and other interested persons. These minutes shall be received by all parties prior to the next scheduled "progress meeting."

Article 40 Protection of Work and Property

A. All trees along the way of access shall be boxed, also all trees surrounding the building which are liable to injury by the moving, storing and working up of materials. No permanent tree shall be used for attachment of any ropes or derricks. Every public way, catch basin, conduit, tree, fence or things injured in carrying out this Contract, shall be replaced and put in good condition, unless the same shall be permanently done away with by order of the Engineer.

B. The Contractor shall erect and properly maintain at all times as required by the conditions and progress of the work, all necessary safeguards for the protection of workers and the public and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hod hoists, well holes, elevator hatchways, scaffolding, window openings, stairways and falling material.

C. In an emergency affecting the safety of life, or of the work, or of the adjoining property, the contractor, without special instruction or authorization is hereby permitted to act, at his/her discretion, to prevent such threatened loss or injury, and he/she shall so act, without appeal, if so instructed or authorized. Any compensation claimed by the Contractor on account of emergency work shall be determined as outlined in Article 11.

Article 41 Shoring, Bracing and Sheeting

A. The Contractor shall do all necessary shoring, bracing and sheeting required, or as directed by the Engineer, to carryout the work, install the foundations and other building construction, to protect the street, sidewalks and all adjoining buildings and property. He/she shall thoroughly brace and protect all earth banks sides of pits, trenches, and other excavations to prevent danger to persons or structures, and to prevent injurious cavings or erosion of any sort. Shoring and sheeting shall be removed after, or as, the walls are built and properly set.

B. Full responsibility for both the design (by an Engineer licensed in Maryland) and the execution of all shoring, bracing, and sheeting work shall rest upon the contractor. While the Engineer shall be fully advised of all details for such work before the work itself is executed, this shall not in any way relieve the Contractor for full responsibility for all damage or expense arising from faulty installation of the said work of shoring, bracing, or sheeting.

Article 42 Tests

A. Soils testing shall be performed by an independent testing firm arranged and paid for by the County.

B. Materials testing shall be performed by an independent testing firm, paid for by the Contractor, which has previously been approved by the County and Architect/Engineer. Certified copies of all such test reports shall be submitted to the Engineer for approval.

Article 43 Cleaning Up

A. The Contractor shall at all times keep the premises free from accumulations of waste material or rubbish caused by his/her employees or work, and at the completion of the work, shall remove all his/her rubbish from and about the project site, and all his/her tools, scaffolding and surplus material.

In case of dispute, the County may remove the rubbish and charge the cost to the several contractors as the Engineer shall determine to be just.

B. All debris shall be kept sprinkled to reduce dust and shall be promptly removed from the building, and no combustible materials shall be stored against perimeter walls.

C. The Contractor shall clean entirely the building as it is completed, wash all windows, scrub all floors at least once, and leave all floors free from spots and blemishes. The interior of the building and the project area shall be left "broom clean," or its equivalent.

Article 44 As-Built Drawings

The Contractor shall, as the project progresses, neatly record on a set of white prints any changes and all revisions to the work wherever they shall differ from the Contract Drawings. Upon completion of the work, the Contractor shall turn over to the Architect this set of prints.

Article 45 Drainage and Pumping

The Contractor shall remove all water, including rain water, encountered during the entire progress of the work, using pumps, drains or other methods approved by the Engineer. Excavations and the project site shall be kept free from water until all backfilling is completed. The water shall be discharged to catch basins, or other drainage points as directed by the Engineer.

Article 46 Temporary Water, Electric and Other Services

A. The Contractor shall arrange for and pay for the installation of temporary connection to the County's water mains, including all incidental fees and expenses for water supply during construction of the project, and shall pay for all water used. Wasting of County water will not be permitted.

B. The Contractor shall arrange for and pay for temporary electric light and power service required during construction of the project, and shall pay for all electricity used. Gasoline or other torches for lighting will not be permitted.

C. The Contractor shall provide and pay for any other temporary services which may be required for the satisfactory completion of the project.

D. The Contractor shall provide, at his/her own expense, all cold weather protection, temporary heat and fuel as necessary to carry on the work expeditiously during inclement weather, to protect work and materials against injury from dampness and cold, to dry out the building and provide suitable working conditions. Refer to other sections for temperatures required for work under the various trades.

The methods of heating and type of fuel and equipment used shall be subject to approval by Engineer.

With special permission, in writing, permanent heating system may be used to dry out building and provide suitable working conditions in all or various parts thereof as soon as practicable. If used, Contractor shall be responsible for use of permanent heating system for purpose described and all costs of fuel, attendance, etc. in connection therewith shall be borne by him/her. Such use shall not relieve Contractor of his/her responsibility to turn over system to Owner in perfect condition on completion of project, including the removal of all dust of construction from air handling units, etc., the replacing of all filters, etc., nor shall it shorten stipulated guarantee period which will commence upon the date of final acceptance of the work.

Article 47 Connecting to Existing Utilities

The Contractor shall, at his/her own cost and expense and as part of this work under the Contract, furnish all labor, materials, tools, and appliances, and do all work required for making connections to existing storm drains, sanitary sewer, water, gas and electric service connections, as shown on drawings, and the cost of making such connections shall be included in his/her bid.

Article 48 Existing Utilities Shown on Plans

Water mains, gas mains, storm drains, sanitary sewers, and other utilities are shown on the Plans, in accordance with the best information available, for the information of the Contractor. The County assumes no responsibility for accuracy or completeness of the information shown. Existing mains and services shall be carefully protected and any damage to them caused by the work shall be immediately repaired to the satisfaction of the Engineer by the Contractor at his own expense, using materials of the quality and kinds damaged.

X. MISCELLANEOUS ADDENDA

Article 49 Holidays

The word "holidays" used in these Contract Documents shall be taken to mean the below listed holidays, which in Baltimore County, occur as shown below:

January 1	New Year's Day
3rd Monday in January	Martin Luther King's Birthday
3rd Monday in February	President's Day
4th Monday in May	Memorial Day
July 4	Independence Day
1st Monday in September	Labor Day
2nd Monday in October	Columbus Day
November 11	Veteran's Day
4th Thursday in November	Thanksgiving Day
December 25	Christmas
All Days of General Elections	

If any holiday occurs on Sunday, the following Monday shall be considered a holiday. If the holiday occurs on Saturday, the Friday immediately preceding shall be considered a holiday.

Article 50 Buy American Steel Act

The State of Maryland has approved House Bill No. 1659 to "Buy American Steel" for all Public Works projects in the State of Maryland, effective July 1, 1978. Compliance with Article 20.17 Metal Pipe (Page 100) and Article 20.18 Metal for Structures (Page 102) in the *S.H.A. Specifications for Materials, Highways, Bridges and Incidental Structures* dated March 1968 will satisfy this condition. Also see *Baltimore County's Standard Specifications for Construction and Materials* Section GP 7.28.

Article 51 Guarantee

A. The Contractor guarantees all work against faulty or imperfect materials, against all imperfect or careless and/or unskilled workmanship, against all leaks and against all mechanical and electrical failure of equipment for a period of two (2) years from the date of acceptance of the project by the County. See other Sections of this Specification for other guarantees.

B. The Contractor shall remove, replace or re-execute, without cost to the Owner, any work found to be imperfect during the guarantee period.

Article 52 Offices and Telephones

A. The Contractor shall erect and maintain upon the project site, and where directed by the Engineer, suitable offices for his/her own use and that of the Engineer.

B. A room of adequate size shall be provided and maintained in the Contractor's office to be used for "Progress Meetings," which frequently involve fifteen (15 or more persons). This space shall be so arranged that they can be held without interference with or from the other office or supervisory work. The room shall be 300 sq. ft. minimum and l0 ft. minimum width.

These offices shall be provided with adequate heating and lighting, all at the expense of the Contractor. In addition to the above requirements, air-conditioning will be required, the cost of which is to be included in the lump sum bid price. The system must be capable of maintaining a temperature of 80 degrees F dry bulb and approximately 50% relative humidity in the conditioned area when outside temperatures are 95 degrees F dry bulb and 78 degrees F wet bulb.

C. The Engineer's office shall meet or exceed all requirements for a Type 1 office in accordance with *Baltimore County's Standard Specifications for Construction and Materials,* Section 103 Engineer's Office.

The Contractor shall provide telephone and FAX service in the Office of the Engineer. The Contractor shall pay all costs of installation and all charges for local and Baltimore City calls, but will not be expected to pay for long distance calls made from the Engineer's Office.


8'-0"
2" (TYP)
GREEN BORDER
FULL COLOR COUNTY SEAL
BALTIMORE COUNTY
Baltimore County Executive Kevin Kamenetz
and The Baltimore County Council
Eastern Family Resource Center
ARCHITECT/ENGINEER:
Hord Coplan Macht/AMT
CONTRACTOR:
Contract No. : 15025 PO0
For Additional Information
Call: 410-887-2470
4'-0"
4"x4" POSTS
¾" EXTERIOR PLYWOOD
NOTE:
ALL COSTS OF FURNISHING, ERECTING AND MAINTAINING THE "IMPROVEMENT SIGN", INCLUDING POSTS, WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE "LUMP SUM" BID. CONTRACTOR TO PROVIDE 1 SIGN(S).
3'-0"
GREEN LETTERS ON LUMINOUS WHITE BACKGROUND
EX. GRADE
3'-0"

Bid Set
June 16, 2015

hord | coplan | macht

BALTIMORE COUNTY
EASTERN FAMILY RESOURCE CENTER

PROJECT MANUAL - VOLUME I

OWNER
Baltimore County Property Management
12200A Long Green Pike
Glen Arm, MD 21057
p. 410.887.3861

ARCHITECT & INTERIOR DESIGNER
Hord Coplan Macht, Inc.
750 E. Pratt Street, Suite 1100
Baltimore, MD 21202
p. 410.837.7311

CIVIL ENGINEER & LANDSCAPE ARCHITECT
A. Morton Thomas and Associates, Inc.
800 King Farm Blvd., 4th Floor
Rockville, MD 20850

KITCHEN CONSULTANT
Nyikos Associates, Inc.
18219-A Flower Hill Way
Gaithersburg, MD 20879
p. 240.683.9530

STRUCTURAL ENGINEER
Faisant Associates, Inc.
810 Light Street, Suite 100
Baltimore, MD 21230
p. 410.783.1696

M/E/P ENGINEER
Burdette Koehler Murphy & Associates, Inc.
1416 Clarkview Road
Baltimore, MD 21209
p. 410.323.0600

IT ENGINEER
Wright Engineering, LLC
853 Ripple Stream Court
Joppa, MD 21085
p. 410.877.6297

Bid Set
June 16, 2015

hord | coplan | macht

BALTIMORE COUNTY
EASTERN FAMILY RESOURCE CENTER

PROJECT MANUAL - VOLUME I

OWNER
Baltimore County Property Management
12200A Long Green Pike
Glen Arm, MD 21057
p. 410.887.3861

ARCHITECT & INTERIOR DESIGNER
Hord Coplan Macht, Inc.
750 E. Pratt Street, Suite 1100
Baltimore, MD 21202
p. 410.837.7311

CIVIL ENGINEER & LANDSCAPE ARCHITECT
A. Morton Thomas and Associates, Inc.
800 King Farm Blvd., 4th Floor
Rockville, MD 20850

KITCHEN CONSULTANT
Nyikos Associates, Inc.
18219-A Flower Hill Way
Gaithersburg, MD 20879
p. 240.683.9530

STRUCTURAL ENGINEER
Faisant Associates, Inc.
810 Light Street, Suite 100
Baltimore, MD 21230
p. 410.783.1696

M/E/P ENGINEER
Burdette Koehler Murphy & Associates, Inc.
1416 Clarkview Road
Baltimore, MD 21209
p. 410.323.0600

IT ENGINEER
Wright Engineering, LLC
853 Ripple Stream Court
Joppa, MD 21085
p. 410.877.6297

TABLE OF CONTENTS

VOLUME I – DIVISIONS 00 THRU 14

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 01 – GENERAL REQUIREMENTS

DIVISION 03 – CONCRETE

DIVISION 04 – MASONRY

DIVISION 05 – METALS

DIVISION 06 – WOODS, PLASTICS, AND COMPOSITES

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

DIVISION 08 – OPENINGS

DIVISION 09 – FINISHES

VOLUME II – DIVISIONS 21 THRU 33

DIVISION 21 – FIRE PROTECTION

DIVISION 22 – PLUMBING

DIVISION 23 – HVAC

DIVISION 26 - ELECTRICAL

DIVISION 27 – COMMUNICATIONS

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

DIVISION 31 – EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – UTILITIES

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

DOCUMENT 00 31 32

GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

B. A geotechnical investigation report for Project, prepared by D.W. Kozera, Inc., dated October, 19, 2014, is available for viewing as appended to this Document.

END OF DOCUMENT 00 31 32

Geotechnical Engineering Study, Eastern Family Resource Center, Rosedale, Maryland (DWK Contract Number 14086.D)

D.W. KOZERA, INC.

PROFESSIONAL ENGINEERS & GEOLOGISTS

October 17, 2014

Hord/Coplan/Macht
750 E. Pratt Street, Suite 1100
Baltimore, Maryland 21202

Attn: Mr. Chris Parts, AIA
(cparts@hcm2.com)

Subject: Geotechnical Engineering Study, Eastern Family Resource Center, Franklin Square Drive, Rosedale, Maryland (DWK Contract Number 14086.D)

Dear Mr. Parts:

This report presents the results of our geotechnical study prepared for the proposed Eastern Family Resource Center to be constructed along Franklin Square Drive in Rosedale, Maryland. This report was prepared in accordance with our contract dated May 1, 2014.

We appreciate the opportunity to be of service to you and the project team. Please contact us to answer questions related to this study, should they arise.

Very truly yours,
D.W. KOZERA, INC.

I hereby certify that this document was prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.

Andrew MacLeod, P.E.
State of Maryland No. 36622
Expiration: 01-31-2016

David W. Kozera, P.E.
State of Maryland No. 13097
Expiration: 08-20-2016

ec: Faisant Associates, Inc.
Attn: Mr. Kris Thompson, P.E.
(kthompson@faisant.com)
A. Morton Thomas & Associates, Inc.
Attn: Mr. Stephen Jerrick, P.E.
(sjerrick@amtengineering.com)

1408 Bare Hills Road Suite 200
Baltimore, MD 21209 Phone: 410.823.1060 Fax: 410.823.1062

Geotechnical Engineering Study,
Eastern Family Resource Center, Rosedale, Maryland
(DWK Contract Number 14086.D)
October 17, 2014

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The following indicates a summary of the geotechnical findings and recommendations contained within this report.

Proposed Construction- A new four story building, which will house the Eastern Family Resource Center is planned at this site. Significant site grading, new asphalt drives and parking areas, two retaining walls, and two micro-biroretention areas are also proposed as part of this project.

Subsurface Conditions- Man-placed fill soils were encountered in several test borings to depths of up to 17 feet below the ground surface. Firm, natural soils of the Cretaceous age Potomac Group are encountered beneath the man-placed fill or just beneath the ground surface.

-The groundwater is estimated to lie as high as EL 122±, which is within approximately 10 feet of the ground surface at the lower retaining wall.

Seismic Site Class- The site is considered a Site Class D, per IBC 2012.

Earthwork- Conventional earthmoving equipment is expected to be feasible for the cut to fill operations.

-A significant portion of the on-site soils are moderate to highly plastic clays and are not considered suitable for re-use as compacted structural fill. The use of offsite borrow will be required.

-Pavement and sidewalk subgrades shall consist of a minimum of 12 inches of granular material; therefore undercutting and replacing unsuitable material beneath pavements will be required. Alternatively, the top 12 inches of material beneath pavements may be treated with cement, i.e. soil-cement.

-Utility lines entering the building should be backfilled with flowable fill.

Foundation System- The project is expected to be supported on a shallow foundation system. The foundation is expected to be supported on spread footings founded on suitable natural soils of the Potomac Group. New foundations may be designed for an allowable bearing pressure of 3.0 ksf.

- Due to the presence of soils which are moderately to highly susceptible to shrink/swell conditions, exterior footings must be founded at least 48 inches below final exterior grade. See specific recommendations for backfill of foundations.

Floor Slab- The floor slab will be supported on new compacted soils, and may be designed using a modulus of subgrade reaction (k) of 120 pci. Due to the expansive soils, a specific construction sequence for floor slab construction is outlined in this report.

-An underfloor subdrainage system is not considered necessary for the floor slab of the building.

Construction Considerations- Geotechnical observations and testing of foundation installation and earthwork construction should be provided by D. W. Kozera, Inc., in order to verify that the assumptions and recommendations contained in this report require modifications due to unforeseen changes in the subsurface conditions.

1.0 INTRODUCTION

1.1 Purpose and Scope

This report contains the results of our geotechnical investigation and analysis performed for the proposed Eastern Family Resource Center to be constructed along Franklin Square Drive in Rosedale, Maryland. This study was conducted to characterize the subsurface conditions, and to establish engineering properties of the underlying materials in order to develop recommendations for foundation and slab design, as well as earthwork, and constructability issues related to the foundation and site.

The geotechnical investigation was performed in accordance with our proposal dated May 1, 2014 and included:

- Review of available geotechnical and geological data from our previous studies.
- Performance of 14 test borings.
- Evaluation and analysis of the subsurface data.
- Development of preliminary foundation design and construction recommendations.

Refer to our proposal for a list of specific scope items that were included in this work.

1.2 Limitations

This geotechnical study has been prepared in accordance with generally accepted geotechnical engineering practices. It is intended for the exclusive use of Hord/Coplan/Macht for the design and construction of the building as described herein. This report includes both factual and interpreted information. Factual information is defined as objective data based on direct observations, such as soil samples and laboratory testing results. Interpreted information or geotechnical engineering interpretation is based on the engineering judgment, correlation, or extrapolation from factual information.

This report is based on information for the proposed structure that was made available to us at the time of the writing of this report. No warranties, express or implied, are intended or should be assumed. D.W. Kozera, Inc. should be allowed to review the project drawings and specifications as a continuation of our design recommendations and as a precursor to our providing geotechnical engineering services during construction. In the event that any changes in the floor grades, building loads, or structure location as described in this report are planned, the conclusions and recommendations contained herein shall not be considered valid unless D.W. Kozera, Inc. reviews the changes, and either verifies or modifies the conclusions of this report in writing.

Information contained in this report is based on data obtained from limited subsurface exploration that represents the soil conditions only at the specific location and time investigated, and only to the depth penetrated. Subsurface conditions and groundwater levels at other locations or depths may differ from conditions occurring at the investigated locations. An attempt has been made to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction.

D.W. Kozera, Inc. considers construction observations and testing of the foundations and earthwork an integral part of the geotechnical design, and therefore, these services should be provided by the geotechnical engineer of record. This is necessary so that we may modify our assumptions and recommendations based on actual conditions that are exposed during construction and observed by us. We cannot assume responsibility or liability for the adequacy of our foundation recommendations if we do not observe the construction.

1.3 Site Description

The project site is located along Franklin Square Drive at the east end of the Franklin Square Hospital property. The site is bordered by Franklin Square Drive to the south, Franklin Woods Center at 9200 Franklin Square Drive to the east, the Community College of Baltimore County, Essex Campus to the north, and Hospital Drive to the west. The northern part of the site is currently utilized as a parking lot for hospital employees. This portion of the site is a relatively flat asphalt lot with the ground surface sloping gently down from EL 157± in the northwest corner of the project site to EL 147± in the southeast corner of the existing parking lot. An existing soil stockpile lies to the south of this existing parking lot. The stockpile is covered in vegetation and is relatively flat at the top, with an elevation of EL 157±. The site slopes down from this stockpile sharply towards Franklin Square Drive to EL 113± at the southeast corner of the site.

1.4 Proposed Construction

Proposed for this project is a four story building which will house the Eastern Family Resource Center which provides healthcare to the homeless residents of Baltimore County. The building is rectangular with a footprint of approximately 165 feet by 210 feet. The maximum column and wall loads of 350 kips and 5 klf, respectively, were provided by Faisant Associates, Inc. The building is to be slab-on-grade construction with a proposed finished floor elevation of EL 148.20. The building is to be located in the portion of the site currently occupied by the hospital staff parking lot. Cuts of up to approximately 6 feet are estimated to reach the finished floor grade.

An asphalt entrance drive will extend from Franklin Square Drive at the east end of the site. The building will be surrounded by an asphalt drive loop with parking areas on the south, east, and north sides. Two retaining walls, varying in height from approximately 2 to 18 feet, will be constructed along the southern portion of the site. No decision has been made as to whether these walls will be cast-in-place concrete or mechanically stabilized earth retaining walls. Significant grading, including cuts and fills of up to approximately 20 feet, are required to reach proposed site grades. Two micro-bioretention areas are planned between the proposed building and the proposed southern parking area.

1.5 Adjacent Construction/Site History

The proposed building is located approximately 300 feet from adjacent buildings, and this appears to be sufficient distance such that loads from the new building will not adversely affect any adjacent structures. The project site is located on the campus of Franklin Square Hospital, and we have worked on several Hospital projects, including the construction of the existing parking lot which occupies a portion of this project site. Based on information in our files, regarding the previous construction, preparation of suitable paving subgrades for the existing lot required that on-site soils be modified with cement in order to reduce their moisture content to an acceptable level to achieve proper compaction.

1.6 Regional Geology

The project is located within the Atlantic Coastal Plain Physiographic Province. The Atlantic Coastal Plain Province is characterized by sequences of marine and terrestrial sedimentary deposits. In general, the Coastal Plain Province consists of an eastward-thickening wedge of gravels, sands, silts, and clays that have been deposited upon an eroded crystalline basement rock surface that slopes downward toward the east. Many depositional environments existed during the formation of the Coastal Plain. Glacially influenced marine transgressions and regressions, periods of erosion and deposition, fluvial processes, and structural deformations have all played a part in the evolution of the Coastal Plain. As a result of these varying processes, the presence, thickness, and lateral continuity of geologic formations are highly variable.

Based on our experience in the area and our subsurface investigation conducted for this study, the soils at this site can be divided into two strata in increasing depth below ground surface: man-made fill and Potomac Group deposits of the Cretaceous age. These deposits locally consist of three formations, one of which is the Arundel Formation of the Potomac Group. The Arundel clays are known to undergo

significant volume changes if subjected to wetting or drying. Expansion of this clay has been the cause of damage at several locations throughout the Franklin Square Hospital complex.

2.0 SUBSURFACE INVESTIGATION

2.1 Test Boring Investigation

The subsurface investigation for this project was performed from September 22 to October 2, 2014. This investigation consisted of fourteen test borings using hollow stem auger drilling techniques. Standard Penetration Tests (SPT) were conducted, in accordance with ASTM D-1586, at changes in strata or at intervals not exceeding 5 feet. The boring location plan and the test boring logs are included in Appendix A of this report.

2.2 Groundwater Conditions

Water was observed in several of the test borings during and after completion of the drilling. Based measurements at the test borings, the groundwater surface is estimated to lie as high as EL 122±, which is approximately 25 feet below building grades and 6 feet below the proposed bottom of the lower retaining wall. Groundwater levels will fluctuate due to seasonal changes, precipitation, and construction activity.

2.3 Soil Laboratory Testing

Laboratory tests were conducted on a limited number of the collected soil samples. These tests consisted of:

Natural Moisture Content Tests	ASTM D2216
Atterberg Limits Test	ASTM D4318
Particle Size Analysis	ASTM D422
Moisture v. Density	ASTM D698
California Bearing Ratio	ASTM D1883
Organic Content	AASHTO T267
USDA Classification	

Six samples from the project area were tested for classification purposes, per the appropriate ASTM standards. The soils were found to classify as SILTY SAND (SM), CLAYEY SAND (SC), and LEAN CLAY (CL). Two samples from the proposed stormwater management areas were tested for USDA classifications, and two samples from paving areas were tested for Moisture v. Density and California Bearing Ratio. In addition, one sample from the existing stockpile was tested for organic content and was found to have an organic content of 3.9%. The results of the soils laboratory testing are included in Appendix B.

3.0 SUBSURFACE CONDITIONS

3.1 Stratification

The test boring data, visual and laboratory classification of the sampled soils, and our knowledge of local geology were used to separate the soils into two distinct strata, having the following generalized properties.

Stratum A: Man-Placed Fill

Man-placed fill was encountered in the majority of test borings to depths of up to 17 feet below the ground surface. The fill is variable in composition and consistency, and generally consisted of clay, silt, and sand. The penetration resistance in the fill indicated a generally loose to medium density, with SPT blowcounts ranging from 4 to 41 blows per foot (bpf).

Stratum B: Potomac Group Deposits

Deposits from the Cretaceous-age Potomac Group were encountered below the man-placed fill soils to the bottom depths of the test borings, 25 feet below the ground surface. These soils were predominantly classified as LEAN CLAY (CL), but also contain layers of FAT CLAY (CH), CLAYEY SAND (SC), SILTY SAND (SM), and POORLY GRADED SAND (SP). . The density of these soils varied within the profile, with SPT values of 6 to 62 bpf.

4.0 SEISMIC CONSIDERATIONS AND SITE CLASS

This section presents the testing and analysis conducted to evaluate the liquefaction potential of the soils and to determine the 2012 International Building Code (IBC) seismic site class for this project site.

4.1 Liquefaction Potential

Liquefaction typically occurs in loose cohesionless sands located below the water table. The test borings did not encounter these conditions, and therefore a liquefaction analysis is not warranted.

4.2 IBC 2012 Seismic Site Class and Design Parameters

Seismic design parameters were determined in accordance with the 2012 International Building Code (IBC). The "U.S. Seismic Design Map Web Application" available through the USGS website provides hazard curves, uniform hazard response spectra, and design parameters for sites in the 50 states of the United States, Puerto Rico, and the U.S. Virgin Islands. These parameters were developed using two-percent probability of exceedence (PE) in 50 years. Following are the mapped spectral response acceleration values for the project site at Latitude (39.5003) and Longitude (-76.5318).

Table No. 4-1: Mapped Spectral Response Acceleration Values for Soil Factors of 1.0

Description	Period (Sec)	Sa
Mapped Short Period Spectral Response Acceleration (S_S)	0.2	0.136 g
Mapped 1-Second Period Spectral Response Acceleration (S_1)	1.0	0.052 g

The Seismic Site Classification influences the determination of the Site Coefficients, the Design Spectral Response Acceleration values, and ultimately the Seismic Design Category. Note that the Seismic Site Classification is based on the characteristics of the upper 100 feet of soils and rock below the site. The IBC requires the use of Standard Penetration Test Resistance (test borings), Shear Wave Velocity (geophysical methods), and/or Undrained Shear Strength (soil laboratory testing) to categorize the Seismic Site Classification.

The Seismic Site Classification was determined to be Site Class D based on the test borings performed for this study. For a Site Class D, with the above-indicated mapped spectral acceleration values, the following are the calculated Site Coefficient values and the Maximum and Design Spectral Response Acceleration values, per IBC Section 1613.5.

Table No. 4-2: Site Class, Site Coefficients, and Design Spectral Response Acceleration

Site Class	D
Soil Profile	Stiff Soil Profile
Site Coefficient (Fa)	1.6
Site Coefficient (Fv)	2.4
Short Period, Maximum Spectral Response Acceleration (S_{MS})	0.217 g
1.0 Second Period, Maximum Spectral Response Acceleration (S_{M1})	0.125 g
Short Period, Design Spectral Response Acceleration (S_{DS})	0.145 g
1.0 Second Period, Design Spectral Response Acceleration (S_{D1})	0.084 g

The Design Spectral Response Acceleration values are to be used with the Occupancy Category (IBC 2012, Table 1604.5) of the building or structure to determine the Seismic Design Category. Complete results of Spectral Acceleration with varying period are given in Appendix C.

5.0 EARTHWORK

5.1 Discussion

Cuts and fills of up to 20 feet and 18 feet, respectively, are anticipated to reach proposed site and floor grades. Based on the grading plan dated September 16, 2014, it appears that the site is unbalanced, requiring significantly more cuts than fills, as such, disposal (haul off) of this material is expected. The majority of fills are to be placed in the southwest corner of the site, adjacent to the proposed retaining wall. Careful subgrade preparation, including stripping of existing asphalt, organic layers, and/or soft surface soils, is required to prepare a suitable fill subgrade. Earthwork is recommended to take place in the warmer, drier months between May and October. The re-use of on-site soils is not expected.

Borings SWM-1, SWM-2, and P-3 were performed into the existing stockpile, which is located to the south of the existing parking lot. Generally, the material in the stockpile was observed to be lean clay with varying amounts of sand. Organic material was observed in several samples, prompting the organic content testing. An organic content of 3.9% was determined in accordance with AASHTO T267, and this material is not considered suitable for re-use as compacted structural fill.

Special precautions will be required for earthwork beneath floor slabs and pavements due to the shrink/swell characteristics of the soils on-site. These details are discussed in their respective sections of this report.

5.2 Excavation Characteristics

The excavation of this site is expected to be performed using conventional earthmoving equipment. Careful preparation of fill subgrades, proper placement and compaction of structural fill and backfill are both necessary to prepare a suitable site for the support of the proposed structures. Details of these requirements are included in the following sections.

5.3 Fill Subgrade Preparation

All vegetation, pavements, and topsoil located below proposed structures should be removed from the fill subgrades prior to filling. The fill subgrades should be proofrolled to assure that all unsuitable, soft and loose soils have been removed from below the building and pavement areas. During proofrolling, the subgrades should be observed by the geotechnical engineer of record. Any unsuitable soils that are observed to be excessively settling or pumping during proofrolling, should be removed down to firm soils and then replaced with satisfactory soil materials compacted in accordance with the project specifications.

A significant portion of the on-site soils classified as LEAN CLAY with a plasticity index greater than 15, and a natural moisture content at or below the Plastic Limit, indicating that they are moderately susceptible to shrink/swell conditions; however, given our experience with adjacent sites, it is expected that problems due to the expansion of these soils may occur if precautions are not taken. Care must be taken to protect fill subgrades during construction. The on-site soils may become unstable in wet weather and under construction traffic. Undercutting of floor, fill, and pavement subgrades should be expected if the subgrades are exposed to the above events. The Project Specifications should require the contractor be responsible for protecting the subgrades from weather and equipment damage.

5.4 Compacted Structural Fill

Compacted structural fill and backfill should consist of satisfactory soils classified as SM or better in accordance with the Unified Soil Classification System, ASTM D2487. Soils meeting this requirement are classified as SM, SP, SW, GM, GP, and GW. The majority of on-site soils are not expected to meet this requirement and may not be used in fills. Unsatisfactory soils are those classified as CL, ML, OL, OH, MH, and CH. SC and GC materials may be suitable depending on their fine content and plasticity. Suitable

material must have less than 35 percent passing the No. 200 sieve, and a Plasticity Index (PI) of less than 6.

Soils used for compacted fill should be free of unsuitable materials such as topsoil, other organics, rubble, and rocks larger than three inches in diameter. The in-place moisture content of the satisfactory soils material shall be adjusted by the contractor, through wetting or drying, to within three percent of the optimum moisture content. Additives such as quick lime, kiln dust, fly ash, or Portland cement may be useful in expediting fill operations.

Compacted fill should be placed on subgrades which have first been stripped of vegetation, existing asphalt, topsoil, and unsuitable soft areas. Compacted structural fill should be placed in approximately horizontal layers, each layer having a loose thickness of not more than eight inches. Due to the existing topography, benching into existing slopes will be required in order to allow for fill to be placed in horizontal layers. All structural fill in the building and pavement areas should be compacted to 95 percent of the maximum dry density in accordance with ASTM D698, Standard Proctor. Structural fill placed in the top 12 inches beneath pavements should be compacted to 100 percent of this same standard, while compacted structural fill in lawns and unpaved areas may be compacted to 90 percent of the same standard, when placed as indicated above. The contractor should select appropriate compaction equipment to achieve the required compaction.

5.5 Utility Backfill

Although typically not part of the design consideration, it is imperative that any new utility lines which enter or exit the building be backfilled filled with flowable fill. The purpose of this flowable fill is to cut off any water source into the underlying clay below the new structure. By placing a relatively impermeable fill, in lieu of the often used open graded (No. 57) stone, the introduction of surface water through utility trenches to the clay soils below the building can be minimized.

5.6 Backfill of Foundations

It is recommended that the exterior side of exterior foundation walls and footings be backfilled with on-site material or flowable fill to within 12 inches of final exterior grades. Moisture conditioning of the on-site material is expected to be required in order to achieve proper compaction. Final grading shall be performed to direct surface water away from the building. These precautions are to help minimize the infiltration of surface water to foundation subgrades.

6.0 FOUNDATION DESIGN

6.1 Summary

We have conducted our geotechnical analysis for foundation design based on the results of the test borings, laboratory tests, and our experience with similar geologic conditions. The maximum column and wall loads for the building are expected to be 350 kips and 5 klf, respectively, as provided by Faisant Associates, Inc. Conventional spread footings are feasible to support these loads. Due to the expansive nature of the Arundel clays, exterior foundations should be founded a minimum of 48 inches below final exterior grade. Based on a proposed finished floor elevation of EL 148.20, existing fill soils and natural soils of the Potomac Group are expected to be encountered at foundation grades. The existing fill soils are not suitable for support of the foundations and must be undercut to suitable natural soils.

6.2 Spread Footings on Natural Soil

An allowable soil bearing pressure of 3.0 ksf is recommended for footings founded on suitable natural soils of Stratum B. Based on the test borings performed in the building area, these suitable soils are expected to be encountered at foundation grades in the northern portion of the proposed building; however, subgrades in the southern portion of the building are expected to consist of existing fill soils and will require undercutting. During excavation for footings, some unsuitable, soft or loose natural soils or existing fill soils may be encountered, which must be removed by undercutting. The footing should be placed directly on the lowered subgrade. Alternatively, the undercut subgrade may be backfilled with lean concrete, allowing the footing to be placed at the designed elevation. Table 6-1 presents the highest elevation of suitable bearing soils encountered in each test boring.

Table 6-1: Highest Elevation of Suitable Bearing Soils

Test Boring	Existing Ground Surface Elevation	Proposed Finished Floor Elevation	Highest Elevation of Suitable Bearing Soils
B-1	EL 154±	EL 148.20	EL 149±
B-2	EL 150±	EL 148.20	EL 145±
B-3	EL 151±	EL 148.20	EL 149±
B-4	EL 148±	EL 148.20	EL 145±
B-5	EL 147±	EL 148.20	EL 140±
B-6	EL 147±	EL 148.20	EL 143±

All exterior footings should be placed at least 48 inches below final exterior grade to minimize swell potential due to seasonal variation of the moisture content of the subgrade soils. This depth will also satisfy frost depth requirements for exterior foundations. Interior footings may be installed at nominal structural depths where suitable soils are encountered. All footings should be at least 16 inches wide for shear considerations and a maximum slope of 2H:1V should be maintained between the bottom edges of adjacent footings where foundation grades are at different levels. Hand cleaning of the footing subgrades will be required to remove disturbed soils. This may occur from the backhoe excavation, ponding of water, trench collapse, etc.

We expect that total foundation settlement of less than one inch and distortional settlement of 0.002 in/in can be expected when spread footings are placed in accordance with the recommendations provided in this report. Footing subgrades are expected to consist of material which is subject to volume changes due

to changes in moisture content; therefore, footings must be excavated and poured in the same day in order to minimize wetting or drying (causing swelling or shrinking) of the subgrade soils. The suitability of footing subgrades should be evaluated during construction by a geotechnical engineer from our office.

7.0 FLOOR SLAB

7.1 Floor Slab Support

The floor slab subgrades are expected to consist of existing fill soils and natural soils. These on-site soils are highly susceptible to volume changes if subjected to wetting or drying. For this reason, a very specific construction sequence for floor slab installation is required. This sequence should be as follows:

1. Excavate to within 12 inches above the proposed finished floor underslab stone subgrade elevation to allow installation of footings and utilities.
2. Immediately prior to pouring the floor slab, excavate to 12 inches below the proposed floor slab stone subgrade and cover with a layer of polyethylene sheeting having a minimum thickness of 10 mil.
3. Place a minimum of 12 inches of granular compacted structural fill or crushed stone to reach the elevation of the open-graded stone subgrade beneath the floor slab.
4. Place 4 inches of open graded stone (No. 57 size), place floor reinforcing steel, and pour the concrete floor slab.

Floor slabs-on-grade may be designed using a modulus of subgrade reaction, k, equal to 120 pci. Groundwater is estimated to be greater than 20 feet below the proposed finished floor grades and a special underfloor subdrainage system is not considered necessary.

SECTION 8: LATERAL EARTH PRESSURES

8.1 Discussion

The proposed exterior grades at the southeast corner of the building are to be up to approximately 5 feet below the finished floor elevation; therefore, the building walls at the southeast corner will be retaining several feet of earth supporting the floor slab. In addition, two retaining walls, up to 18 feet high, are planned for the southern portion of the site. Recommended parameters for cantilevered retaining wall design are indicated on Figure 8-1, while recommendations for braced walls are included on Figure 8-2. The ponding of precipitation behind the walls should be avoided during construction as the pressure diagrams included do not include hydrostatic pressure. A Factor of Safety of at least 1.5 should be used for evaluation of overturning and sliding of the walls using the parameters indicated on the lateral earth pressure diagrams. Conventional foundation subdrainage or weep holes should be used to prevent buildup of hydrostatic pressure behind walls.

Specific material and compaction requirements for fill against walls below grade are included in Section 5.4 of this report. Compacted fill behind and in front of the walls should be free of organics and rocks larger than 3 inches in diameter, and should consist of soils classifying SM or coarser. The on-site soils are not expected to meet these criteria and the use of borrow material will be required. Compaction equipment exceeding 3,000 pounds in dead weight should not be used within 5 feet of the walls in order to avoid overloading the walls

SECTION 9: PAVEMENT DESIGN

9.1 Discussion

The proposed building is to be surrounded by an asphalt drive with a large parking area on the north side, and two smaller parking areas on the east and south sides. The proposed entrance drive is to extend from Franklin Square Drive. Pavement subgrades are expected to consist of existing fill soils, natural soils, and newly placed compacted structural fill. Due to the shrink/swell characteristics of the existing fill and natural soils, it is recommended that pavement subgrades consist of a minimum of 12 inches of material classifying as SM or better; therefore, pavement subgrades consisting of natural soils or existing fill soils are expected to be undercut 12 inches and replaced with compacted structural fill. An alternative to this undercut and replace method beneath the pavements would be to treat the top 12 inches of the pavement subgrades through cement modification. Laboratory testing of the on-site materials will be required to determine the appropriate amount of cement necessary, but 5% cement by weight is considered reasonable for budgeting purposes. Pavement sections are presented for light-duty (automobile only) and medium-duty sections.

9.2 Pavement Subgrade Preparation

Pavement and sidewalk subgrades are to consist of a minimum of 12 inches of granular material, classified as SM or better, or a minimum of 12 inches of cement-modified material. Careful subgrade preparation, including the stripping of existing asphalt, topsoil and organic layers, and re-compaction and proofrolling, is strongly recommended. All subgrades should be proofrolled with a loaded 20 ton dump truck, and any unsuitable soft or loose areas detected should be removed and replaced with satisfactory compacted fill or stone base course. Some undercutting of unsuitable soils should be expected, in order to produce a pavement subgrade suitable for the pavement design provided below. The majority of pavement subgrades are expected to consist of natural clay material which is subject to volume changes due to changes in moisture content; therefore, care must be taken during construction in order to minimize wetting or drying (causing swelling or shrinking) of the subgrade soils. It is recommended that the stone base course be placed immediately after proofrolling in order to protect the subgrades. Compacted fill placed for pavement support should be placed in accordance with the recommendations contained in Section 5.4 of this report. The pavement subgrades should be observed carefully to determine that the soils meet the soil classification that is used in our analysis.

9.3 Design/Analysis

Parking areas and driveways will be used to support automobiles, and light delivery trucks. A light-duty pavement section may be used in areas that will be restricted to use solely by automobiles. Parking lot access roads and entrances that may be used by heavier vehicles should be designed as medium-duty, including the expected routes to be used by trash trucks.

Soil laboratory testing for the on-site soils indicated a CBR value of 12.2 for the CLAYEY SAND soils. The CBR value is generally considered as "good" for pavement support. We expect these soils to make up a portion of the pavement subgrades; however, to account for other areas of poorer quality soils, the laboratory CBR value was reduced by a factor of 0.67 to yield a design CBR value of 8.2. This design CBR value was used for our analysis.

Table 9-1: Recommended Pavement Section	
Light-Duty Pavement (Automobile Only)	**Medium-Duty Pavement**
10,000 ESALs	100,000 ESALs
1.5-Inches Asphalt Surface Course	1.5-Inches Asphalt Surface Course
2.5-Inches Asphalt Base Course	3.5-Inches Asphalt Base Course
6.0-Inches Stone Base Course	6.0-Inches Stone Base Course

The bituminous concrete surface and base course material should be selected by the civil engineer to provide a stable and relatively impervious pavement section. The stone base course should meet the

specifications of MSHA GA Base, and be compacted to at least 95 percent of the maximum dry density per AASHTO T180.

9.4 Pavements During Construction

The recommended pavement sections are not designed to accommodate construction traffic. It should be expected that damage will occur due to overloading of the pavement sections if they are subjected to construction traffic. This will be prevalent especially if water is allowed to collect on or in the pavement subgrades, and if only the base course is placed prior to the completion of the construction. Provisions should be made to minimize damage to the pavements during construction including the use of subdrainage, temporary swales or berms, the limitation of construction traffic to certain areas, and/or an increased thickness of stone or base asphalt. An allowance should be reserved for the cost of repairs to the base paving prior to completion of the final surface-course of asphalt.

The pavement design assumes that a continual maintenance program will be implemented during the service life of the project. This should include crack and surface sealing, and patching of deteriorated areas.

10.0 STORMWATER MANAGEMENT RECOMMENDATIONS

10.1 Discussion

It is our understanding that two micro-bioretention areas are planned for the site. These facilities are to be located to the south of the proposed building. Initial infiltration feasibility testing based on visual and laboratory classification was performed for this study per Maryland Stormwater Design Manual, 2000. Two in-situ infiltration tests, one in each proposed device location, were also performed to evaluate the infiltration characteristics of the on-site soils.

10.2 Stormwater Management Infiltration Recommendations

The Stormwater Management Administration of the Maryland Department of the Environment (MDE) has set particular standards and specifications for the design and construction of stormwater infiltration devices. These regulations include parameters on soil textures, depth of limiting zone, and other considerations, which are described in the publication "Maryland Stormwater Design Manual, 2000."

Appendix D.1 of the MDE manual describes geotechnical testing requirements prior to the final design of a stormwater management facility. The manual requires *initial feasibility testing* to determine the likelihood of using infiltration characteristics for stormwater management. If infiltration appears feasible based on the initial testing, then *concept design testing* is required to approximate actual infiltration rates. Concept design testing consists of in-situ infiltration testing of the proposed bottom of the facility. Initial feasibility testing based on visual and laboratory classification was performed for this study in the proposed stormwater management areas, and indicated that the use of stormwater infiltration may be an acceptable practice at limited horizons below the proposed locations based on soil classification and limiting zones of bedrock. Two in-situ tests were performed to confirm these opinions.

10.2.1 Soil Textures

The MDE publication requires USDA Soil Textural Classifications for each type of soil below the infiltration device. These classifications are used to correlate the material with typical minimum infiltration rates. The State indicates that soil textures with a minimum infiltration rate of greater than 0.52 inches per hour are required for infiltration devices.

USDA testing was performed on two representative samples obtained from the borings located within the stormwater management area. The testing indicates that the samples classify as SAND and SANDY LOAM. These classifications correlate to minimum infiltration rates of 8.27, and 1.02 inches per hour, respectively. These classifications are considered suitable for infiltration practices, after verification with in-situ testing.

10.2.2 Depth to Limiting Zone

The MDE publication recommends that a four foot distance be provided between the bottom of the infiltration system and any limiting zones. Limiting zones are defined as a seasonable high water table or bedrock. Founding of infiltration facilities within existing fill soils is also prohibited, in accordance with the publication. Limiting zones were not encountered in the SWM test borings.

10.2.3 Infiltration Summary

The following table summarizes our observations and testing:

Table 10-1: Stormwater Management Infiltration Summary							
Test Boring	**Test Boring Depth (ft)**	**Existing Grade (EL±)**	**Test Depth (ft)**	**USDA Classification at Test Depth**	**USDA Predicted Infiltration (in/hr)**	**Measured In-Situ Infiltration (in/hr)**	**Remarks**
SWM-1	30	157	28.0	SANDY LOAM	1.02	0.36	1
SWM-2	30	156	27.0	SAND	8.27	0.48	1
Remarks: 1. Infiltration practices not recommended due to low in-situ infiltration rate.							

10.2.4 Remarks

The measured in-situ infiltration rates are lower than the minimum required by MDE for infiltration practices. The measured rates are also lower than those predicted from the USDA classifications. This is believed to be due to layering of finer material within the soil profile. Generally, infiltration rates of stormwater are expected to be highly variable based on the classification of the soils. The actual infiltration rates observed in the completed stormwater structures may differ from those indicated above, and will be dependent upon the soil types encountered in the structure subgrades and the methods used by the contractor to construct the facilities. The structures should be observed by our personnel during construction to evaluate the soils types encountered. The subgrades should be carefully excavated by the contractor to minimize disturbance of the natural conditions. No mechanical compaction of the subgrades will be necessary or allowed.

11.0 CONSTRUCTION CONSIDERATIONS

Specific recommendations for foundation construction are given below:

11.1 Earthwork

The site surface asphalt should be stripped, as well as all existing topsoil from landscape areas and soft surface soils. The resulting subgrades should be proofrolled under the observation of our representative. Any soft or unsuitable soils encountered should be removed and replaced with compacted structural fill. Offsite borrow material will be required for use as compacted structural fill.

11.2 Spread Footings

Care should be exercised during the excavation for all footings to minimize disturbance of the footing and fill subgrades. If subgrades are disturbed, the subgrades should be lowered to undisturbed soils. Due to the plastic nature of the on-site soils and their susceptibility to volume changes, footings should be excavated and concreted the same day in order to avoid ponding of surface runoff water in footing excavations, and to avoid other disturbances such as freezing, extreme moisture variations (wetting or drying), etc. A mud mat consisting of a minimum of two inches of lean concrete may be placed to preserve the subgrades after the subgrade is approved by an engineer from our office. Hand cleaning of the disturbed soils left by the backhoe excavation will be required to produce a minimally disturbed subgrade. A flat-bladed excavation bucket will help to minimize the hand work.

11.3 Compacted Structural Fill

Compacted fill should meet the requirements outlined in this report. All compacted structural fill and backfill below slabs, and as backfill behind walls should be compacted to 95 percent of the maximum dry density per ASTM D698, Standard Proctor. Compacted fill directly beneath pavements shall be compacted to 100% of the same standard. Moisture conditioning, such as wetting or drying, should be expected to be required depending on the time of year construction occurs. Soil additives such as lime, cement or kiln dust may be used to expedite compaction in soils above the optimum moisture for compaction.

11.4 Review of Construction Documents

Any deviation to the project design subsequent to the date of this report, such as changes in floor grades, building loads and building location, should be brought to our attention to determine if our recommendations contained herein remain valid.

The information provided in this report may be used to produce project drawings and specifications. We should be allowed to review the project drawings and specifications, as a follow-up to our design recommendations and as a precursor to our providing the geotechnical engineering services during construction.

11.5 Construction Observations and Testing

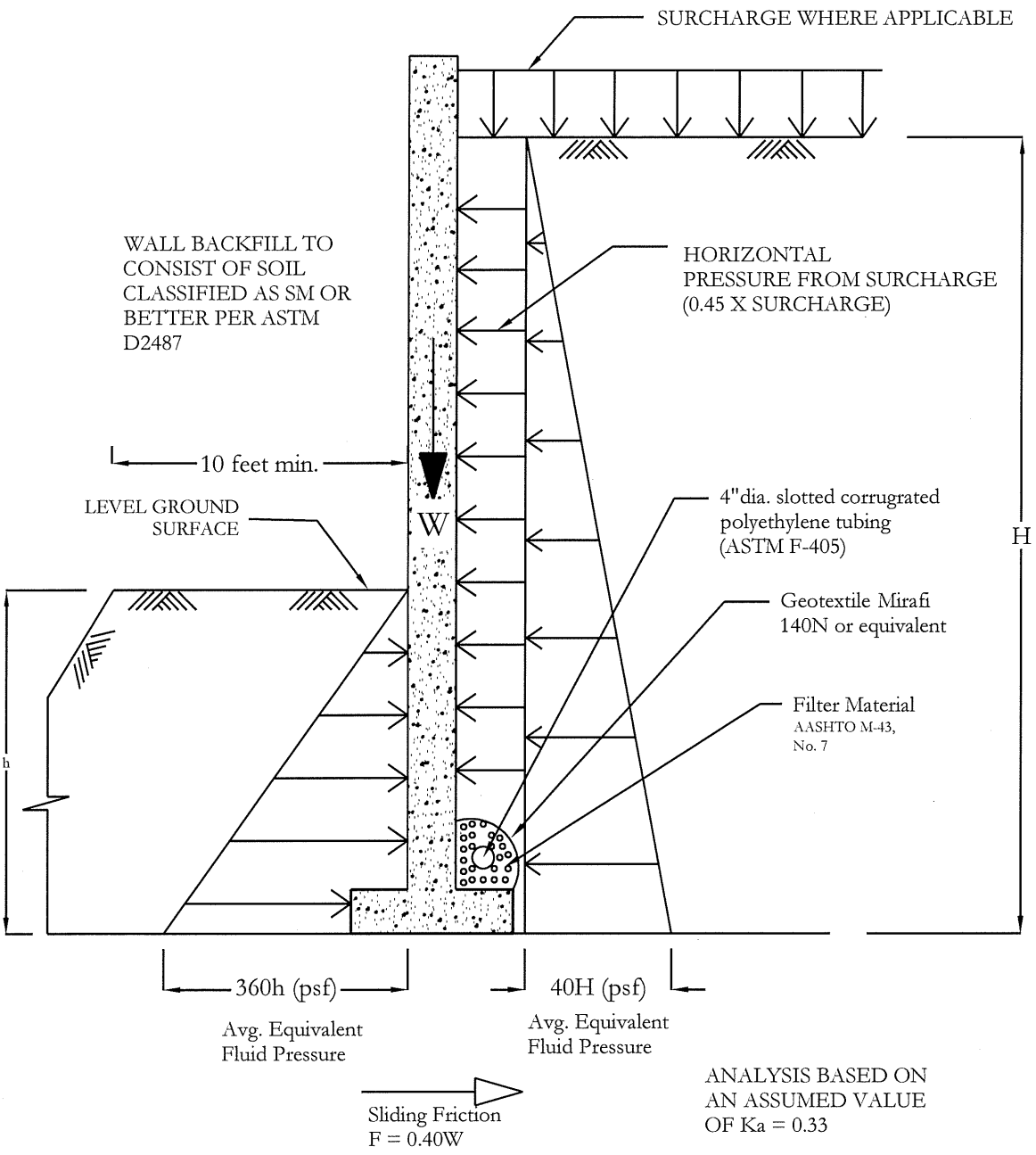
Regardless of the thoroughness of a geotechnical engineering exploration, there is always a possibility that conditions will vary from those encountered in the test borings, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. D.W. Kozera, Inc. considers construction observation and testing of the foundations and earthwork an integral part of the geotechnical design, and therefore these services should be provided by the geotechnical engineer of record. As actual subsurface conditions are exposed and observed by us during construction, modifications to our report recommendations can be made promptly and efficiently as needed.

Observations and testing should at minimum include full-time observations of the excavation of footing, fill, and floor subgrades, and field density testing of compacted structural fill. Other services, including

materials testing (concrete, reinforcing steel, bituminous concrete, masonry, etc) can be provided upon request.

Figure 8-1

Lateral Earth Pressures – Cantilevered Walls



CANTILEVERED WALLS

LATERAL EARTH PRESSURE DIAGRAM

D.W. KOZERA, INC.
PROFESSIONAL ENGINEERS AND GEOLOGISTS
1408 Bare Hills Rd. Baltimore, MD 21209
PH. 410.823.1060 FAX. 410.823.1062

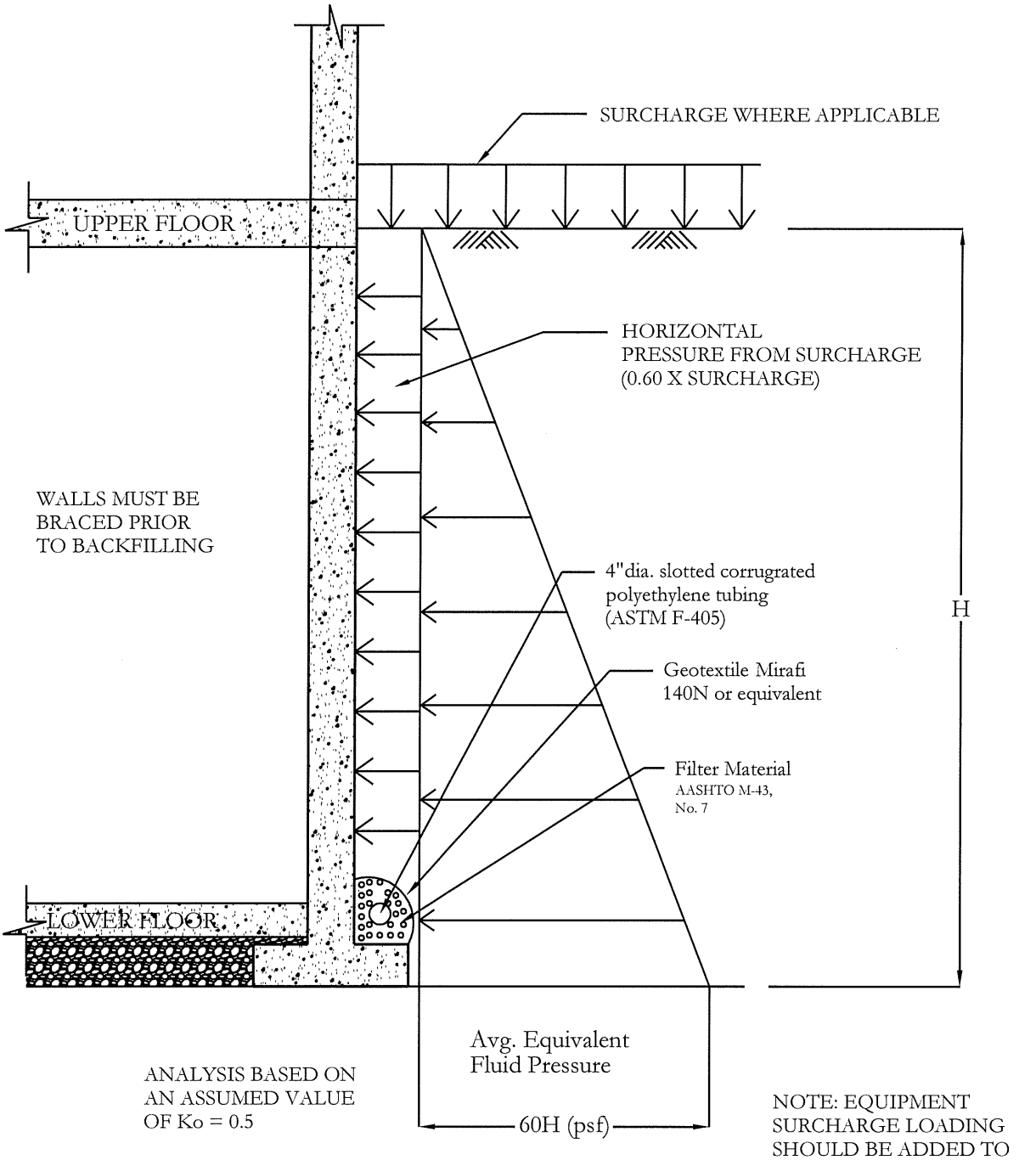
EASTERN FAMILY RESOURCE CENTER

BALTIMORE, MD

Proj #: 14086.D	
Date: 10.15.14	
Figure: 8-1	Prep. by: NM
Scale: NTS	Rev. by: AM

Figure 8-2

Lateral Earth Pressures – Braced Walls



BRACED WALLS

(BACKFILLED AFTER CONSTRUCTION)

LATERAL EARTH PRESSURE DIAGRAM

D.W. KOZERA, INC.
PROFESSIONAL ENGINEERS AND GEOLOGISTS
1408 Bare Hills Rd. Baltimore, MD 21209
PH. 410.823.1060 FAX. 410.823.1062

EASTERN FAMILY RESOURCE CENTER

BALTIMORE, MD

Proj #: 14086.D

Date: 10.15.14

Figure: 8-2 | Prep. by: NM

Scale: NTS | Rev. by: AM

APPENDIX A

Subsurface Investigation Report

APPENDIX A
GENERAL NOTES FOR TEST BORINGS AND TEST PITS

Geotechnical Engineering Study, Eastern Family Resource Center
Rosedale, Maryland
(DWK Contract Number 14086.D)

1. Test Borings

Test borings are advanced by turning an auger with a center opening of 2-1/2 or 3-1/4 inches. Cuttings are brought to the surface by the auger flights. Sampling is performed through the center opening in the hollow stem auger by standard methods. No water was introduced into the borings using this procedure.

1.1 Standard Penetration Tests

Testing is performed by driving a two-inch O.D., 1-3/8 inch I.D. sampling spoon through three, six-inch intervals or as indicated, using a 140 pound hammer falling 30 inches according to ASTM D1586. The number given as the 'N' value is the sum of the blows required to drive the samples for the second and third intervals.

2.0 Test Pits

Test pits are logged to provide a record for geotechnical evaluation, construction inspection, or other specialized purpose such as building damage investigations, subgrade inspections, etc.

2.1 Test Procedures

PP, when indicated, denotes the results of tests performed with a Pocket Penetrometer. The numbers indicate the unconfined compressive strength of the undisturbed soils in tsf. DCP, when indicated, denotes the results of tests performed with a Dynamic Cone Penetrometer at an initial seating increment of two-inches, and 1-3/4-inch increments thereafter. The penetrometer is driven by a 15-pound hammer falling 20-inches, and the number of hammer blows per increment is recorded.

3.0 General

The test pits and test boring logs represent subsurface conditions only at the specified location and at the particular time excavated. The passage of time may result in changes in these conditions. Conditions at other locations on the site may differ from conditions occurring at the test pit or test boring location.

The stratification lines represent the approximate boundary line between soil and rock types as observed in the test pit and test boring. The soil profile, foundation dimensions, water level observations, and test results presented on the log have been made with reasonable care and accuracy, but must be considered only an approximate representation of the subsurface conditions to be encountered at that particular location.

The observed water levels are considered a reliable indication of the groundwater table levels at the time indicated. The groundwater table may be completely dependent on the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should be expected with variations in precipitation, surface run-off, evaporation, construction activity, etc.

4.0 Locations and Grades

The test borings were located in the field by D.W. Kozera, Inc. based on drawings provided to us. The ground surface elevations were estimated from the drawings.

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B1
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 154.0
Date Started : 9-23-14
Date Completed : 9-23-14
Contractor : GeoServices Corp.
Driller : J. Beavers
Rig : cme 55, #7 Auto Hammer
Drill Method : 3 1/4" HSA
Inspector : A. MacLeod

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	9-23	11:05	wet	14.0	---
Completion	9-23	11:30	wet	28.5	---
Casing Pulled	9-23	11:42	---	---	15.6
	9-25	08:44	wet	---	14.9

Depth (ft)	Surf. Elev. 154.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0		1	2-5-4	9				sand, silt, gravel, clay, FILL, moist, brown	Fill	A	Topsoil = 2"
		2	4-7-7	14							
	150	3	2-4-6	10			CL	LEAN CLAY, some sand, trace gravel, moist, brown and gray	Potomac	B	
5		4	5-10-11	21			SP	POORLY GRADED SAND, some silt, moist, brown			
	145	5	4-8-9	17			CL	SANDY LEAN CLAY, moist, gray and brown			
10											
	140	6	4-7-8	15			CL	LEAN CLAY, trace sand, moist, brown			
15											
	135	7	3-5-8	13			CL	LEAN CLAY, some sand, moist, brown			
20											
	130	8	4-7-9	16			CL	gray @ 25.2'			
25											
	125	9	4-9-14	23							
30								Bottom of Test Boring @ 30.0'			

TEST_BORING_LOG 14086.GPJ KOZERA.GDT 10/1/14

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B2
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 150.0
Date Started : 9-22-14
Date Completed : 9-22-14
Contractor : GeoServices Corp.
Driller : J. Beavers
Rig : cme 55, #7 Auto Hammer
Drill Method : 3 1/4" HSA
Inspector : A. MacLeod

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	9-22	12:45	---	---	---
Completion	9-22	12:50	---	---	---
Casing Pulled	9-22	12:55	---	---	25.4
	9-25	07:39	---	---	25.4

Depth (ft)	Surf. Elev. 150.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0	150	1	4-4-5	9				sand, silt, clay, roots, FILL, moist, brown	Fill	A	
		2	5-6-6	12				lean clay, some sand and silt, FILL, moist, brown			
5	145	3	4-5-8	13				LEAN CLAY, some sand, moist, brown and gray	Potomac	B	
		4	4-6-9	15							
10	140	5	4-6-9	15				contains ironite fragments @ 9.4'			
15	135	6	4-7-11	18			CL				
20	130	7	3-5-9	14							
25	125	8	6-9-14	23			CL	LEAN CLAY, trace sand, moist, gray and brown			
30	120	9	9-15-28	43			SP	POORLY GRADED SAND, with silt, contians ironite fragments, moist, brown			
								Bottom of Test Boring @ 30.0'			

TEST_BORING_LOG 14086.GPJ KOZERA.GDT 10/16/14

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B3
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 151.0
Date Started : 9-22-14
Date Completed : 9-22-14
Contractor : GeoServices Corp.
Driller : J. Beavers
Rig : cme 55, #7 Auto Hammer
Drill Method : 3 1/4" HSA
Inspector : A. MacLeod

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	9-22	09:30	wet	28.5	---
Completion	9-22	09:41	25.6	28.5	---
Casing Pulled	9-22	10:00	20.8	---	25.3
	9-25	07:00	11.5	---	13.1

Depth (ft)	Surf. Elev. 151.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0	150	1	3-7-7	14				sand, silt, gravel, clay, FILL, moist, brown	Fill	A	Asphalt = 3" Gravel Base = 3"
		2	4-7-10	17			CL	LEAN CLAY, some sand, moist, brown	Potomac	B	
5	145	3	4-8-12	20			CH	FAT CLAY, trace sand, moist, brown			
		4	5-6-8	14			CL	LEAN CLAY with sand, moist, brown			
10	140	5	3-7-9	16	▼		SP	POORLY GRADED SAND, with silt, moist, brown and gray			
15	135	6	3-5-7	12			ML	SILT, some sand, moist, brown and gray			
20	130	7	4-9-12	21			CL	LEAN CLAY, some sand and silt, moist, gray and brown			
25	125	8	8-24-26	50			SM	SILTY SAND, moist, gray and brown			
		9	4-7-11	18			CL	LEAN CLAY, trace sand, wet, gray			
30								Bottom of Test Boring @ 30.0'			

TEST_BORING_LOG 14086.GPJ KOZERA.GDT 10/16/14

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B4
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 148.0
Date Started : 9-22-14
Date Completed : 9-22-14
Contractor : GeoServices Corp.
Driller : J. Beavers
Rig : cme 55, #7 Auto Hammer
Drill Method : 3 1/4" HSA
Inspector : A. MacLeod

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	9-22	10:59	wet	24.0	---
Completion	9-22	11:05	28.2	28.5	---
Casing Pulled	9-22	11:25	---	---	25.4
	9-25	07:20	wet	---	25.4

Depth (ft)	Surf. Elev. 148.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0		1	13-19-22	41				sand, silt, gravel, clay, FILL, moist, brown	Fill	A	Asphalt = 3" Gravel Base = 3"
	145	2	3-4-7	11			CL	LEAN CLAY, some sand and sand lenses and layers, moist, gray and brown	Potomac	B	
5		3	3-5-9	14			CL	LEAN CLAY, some sand, moist, brown			
	140	4	6-10-10	20			SM	SILTY SAND, moist, brown and gray			
10		5	3-6-6	12			CL	LEAN CLAY, trace sand and sand lenses, moist, gray			
	135										
15		6	3-4-8	12			CL	LEAN CLAY, trace sand, moist, gray			
	130										
20		7	4-11-1	12			CL	LEAN CLAY, some sand and silt, contains ironite lenses, moist, brown			
	125										
25		8	7-7-9	16			SM	SILTY SAND, wet, brown and gray			
	120										
30		9	6-7-9	16			CL	LEAN CLAY, some sand, wet, gray Bottom of Test Boring @ 30.0'			

TEST_BORING_LOG 14086.GPJ KOZERA.GDT 10/16/14

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B5
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 147.0
Date Started : 9-23-14
Date Completed : 9-23-14
Contractor : GeoServices Corp.
Driller : J. Beavers
Rig : cme 55, #7 Auto Hammer
Drill Method : 3 1/4" HSA
Inspector : A. MacLeod

	GROUNDWATER OBSERVATIONS				
	Date	Time	Depth	Casing	Caved
Encountered	9-23	10:05	wet	28.5	---
Completion	9-23	10:09	26.8	28.5	---
Casing Pulled	9-23	10:30	26.4	---	26.9
	9-25	08:33	24.2	---	25.1

Depth (ft)	Surf. Elev. 147.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0		1	4-4-3	7				sand, silt, gravel, clay, FILL, moist, brown	Fill	A	Asphalt = 3" Gravel Base = 3"
	145	2	1-2-7	9							
								trace gravel, FILL, moist, brown			
5		3	2-2-3	5							
	140	4	3-4-5	9				LEAN CLAY, trace sand, wet, gray and brown	Potomac	B	
10		5	3-4-6	10							
	135										
15		6	3-5-7	12				contains lignite @ 14.0'			
	130						CL				
20		7	4-7-10	17							
	125										
25		8	2-3-5	8	▼						
	120										
30		9	5-5-7				CL	SANDY LEAN CLAY, contains sand lenses and layers, wet, gray			
								Bottom of Test Boring @ 30.0'			

TEST_BORING_LOG 14086.GPJ KOZERA.GDT 10/1/14

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B6
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 147.0
Date Started : 9-23-14
Date Completed : 9-23-14
Contractor : GeoServices Corp.
Driller : J. Beavers
Rig : cme 55, #7 Auto Hammer
Drill Method : 3 1/4" HSA
Inspector : A. MacLeod

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	9-23	09:00	---	---	---
Completion	9-23	09:05	---	---	---
Casing Pulled	9-23	09:06	---	---	25.4
	9-25	08:05	---	---	20.9

Depth (ft)	Surf. Elev. 147.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0		1	4-5-5	10				sand, silt, gravel, roots, FILL, moist, brown	Fill	A	Topsoil = 2"
	145	2	11-12-7	19							
5		3	4-6-10	16			CL	LEAN CLAY, some sand, moist, brown and gray	Potomac	B	
	140	4	7-7-7	14			SP	POORLY GRADED SAND, with silt, moist, gray and brown			
10		5	3-5-5	10							
	135										
15		6	4-7-9	16							
	130										
20		7	7-10-12	22							
	125										
25		8	5-9-13	22			CL	LEAN CLAY, some sand, moist, brown and gray			
	120										
30		9	6-8-13	21				Bottom of Test Boring @ 30.0'			

TEST_BORING_LOG 14086.GPJ KOZERA.GDT 10/1/14

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: RW-1
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 132.0
Date Started : 10-2-14
Date Completed : 10-2-14
Contractor : GeoServices Corp.
Driller : R. Stidham
Rig : cme 850 Auto
Drill Method : 2 1/4" HSA
Inspector : A. MacLeod

	GROUNDWATER OBSERVATIONS				
	Date	Time	Depth	Casing	Caved
Encountered	10-2	10:30	---	---	---
Completion	10-2	10:35	None	18.5	---
Casing Pulled	10-2	10:45	16.9	---	17.9
	10-3	07:55	10.9	---	11.0

Depth (ft)	Surf. Elev. 132.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0		1	2-2-4	6			SM	SILTY SAND, moist, brown	Potomac	B	Topsoil = 0.1'
	130							FAT CLAY, gray, moist, brown			
		2	4-7-9	16							
5		3	4-7-10	17			CH	trace sand @ 4.5'			
	125	4	5-7-8	15							
							SM	SILTY SAND, organics, decayed wood, moist, gray			
10		5	3-5-7	12	▼						
	120						SP	POORLY GRADED SAND, trace silt layers, moist, brown			
								LEAN CLAY with silty sand and sandy clay layer, sandy silt layer, moist, gray			
15		6	2-3-4	7			CL				
	115										
		7	5-9-14	23			CL	LEAN CLAY, some ironite, trace sand, moist, gray, brown			
20								Bottom of Test Boring @ 20.0'			

TEST_BORING_LOG 14086.GPJ KOZERA.GDT 10/16/14

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: RW-2
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 128.0
Date Started : 10-2-14
Date Completed : 10-2-14
Contractor : GeoServices Corp.
Driller : R. Stidham
Rig : cme 850 Auto
Drill Method : 2 1/4" HSA
Inspector : A. MacLeod

GROUNDWATER OBSERVATIONS	Date	Time	Depth	Casing	Caved
Encountered	10-2	09:45	---	---	---
Completion	10-2	09:50	None	18.5	---
Casing Pulled	10-2	10:00	None	---	16.6
	10-3	07:50	None	---	16.2

Depth (ft)	Surf. Elev. 128.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0		1	2-2-4	6			ML	SANDY SILT, moist, brown	Potomac	B	Topsoil = 0.3'
	125	2	4-5-7	12			SM	SILTY SAND, moist, brown			
5		3	8-10-11	21				some ironite @ 6.0'			
	120	4	6-10-14	24			CL	LEAN CLAY, trace sand, moist, gray, brown			
10		5	7-10-13	23			CH	FAT CLAY, moist, brown			
	115										
15		6	7-12-18	30			CL	LEAN CLAY, trace sand layer @ 14.5'			
	110										
		7	7-14-18	32							
20								Bottom of Test Boring @ 20.0'			

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: RW-3
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 125.0
Date Started : 10-2-14
Date Completed : 10-2-14
Contractor : GeoServices Corp.
Driller : R. Stidham
Rig : cme 850 Auto
Drill Method : 2 1/4" HSA
Inspector : A. MacLeod

	GROUNDWATER OBSERVATIONS				
	Date	Time	Depth	Casing	Caved
Encountered	10-2	08:55	---	---	---
Completion	10-2	09:00	None	18.5	---
Casing Pulled	10-2	09:05	None	---	16.8
	10-3	07:43	None	---	16.5

Depth (ft)	Surf. Elev. 125.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0	125	1	1-3-5	8				silty sand, roots, FILL, moist, brown	Fill	A	Topsoil = 0.2'
		2	6-15-18	33			SP	POORLY GRQADED SAND, some ironite, moist, brown	Potomac	B	
5	120	3	7-7-11	18			SM	SILTY SAND, moist, brown			
		4	7-10-13	23			SC	CLAYEY SAND with sandy silt layers, moist, brown			
10	115	5	6-7-8	15			CH	FAT CLAY, moist, brown			
15	110	6	5-7-9	16			SC	CLAYEY SAND, with clay layers, moist, gray, brown			
		7	5-6-7	13			SC	CLAYEY SAND, with silty sand layers, moist, brown			
20	105							Bottom of Test Boring @ 20.0'			

TEST_BORING_LOG 14086.GPJ KOZERA.GDT 10/16/14

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: P1
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 156.0
Date Started : 9-23-14
Date Completed : 9-23-14
Contractor : GeoServices Corp.
Driller : J. Beavers
Rig : cme 55, #7 Auto Hammer
Drill Method : 3 1/4" HSA
Inspector : A. MacLeod

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	9-23	09:05	---	---	6.3
Completion	9-23	12:05	---	---	---
Casing Pulled	9-23	12:10	---	---	---
	9-23	12:15	---	---	6.4

Depth (ft)	Surf. Elev. 156.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0	155	1	9-11-9	20				sand, silt, gravel, clay, moist, FILL, brown and gray	Fill	A	Asphalt = 3" Gravel Base = 3"
		2	3-6-10	16							
5	150	3	4-5-7	12				sandy lean clay, FILL, moist, brown			
		4	6-11-12	23			CL	LEAN CLAY, with sand, trace gravel, moist, brown	Potomac	B	
		5	5-8-13	21							
10								Bottom of Test Boring @ 10.0'			

TEST_BORING_LOG 14086.GPJ KOZERA.GDT 10/1/14

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: P2
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 153.0
Date Started : 9-23-14
Date Completed : 9-23-14
Contractor : GeoServices Corp.
Driller : J. Beavers
Rig : cme 55, #7 Auto Hammer
Drill Method : 3 1/4" HSA
Inspector : A. MacLeod

	GROUNDWATER OBSERVATIONS				
	Date	Time	Depth	Casing	Caved
Encountered	9-23	01:00	---	---	---
Completion	9-23	01:05	---	---	---
Casing Pulled	9-23	13:10	---	---	6.3
	9-25	09:05	---	---	5.9

Depth (ft)	Surf. Elev. 153.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0		1	7-16-12	28				sand, silt, gravel, clay, concrete fragments, FILL, moist, brown and gray	Fill	A	Asphalt = 3" Gravel Base = 3"
	150	2	11-9-10	19				poorly graded sand, some silt, trace gravel, FILL, moist, brown			
5		3	3-6-10	16			CL	LEAN CLAY, some sand, moist, brown	Potomac	B	
	145	4	7-7-10	17			CL	LEAN CLAY, trace sand, moist, brown and gray			
10		5	4-6-9	15				Bottom of Test Boring @ 10.0'			

TEST_BORING_LOG 14086.GPJ KOZERA.GDT 10/1/14

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: P-3
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 147.0
Date Started : 10-2-14
Date Completed : 10-2-14
Contractor : GeoServices Corp.
Driller : R. Stidham
Rig : cme 850 Auto
Drill Method : 2 1/4" HSA
Inspector : A. MacLeod

	GROUNDWATER OBSERVATIONS				
	Date	Time	Depth	Casing	Caved
Encountered	10-3	07:37	None	---	12.3
Completion	10-2	07:40	---	---	---
Casing Pulled	10-2	07:45	None	13.5	---
	10-2	07:55	None	---	12.3

Depth (ft)	Surf. Elev. 147.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0		1	2-2-4	6				silt, roots, clay, FILL, moist, brown		A	Topsoil = 0.1'
	145	2	2-4-6	10							
		3	4-5-6	11				clay, sticks, wood, gray, FILL, moist, brown	Fill		
5											
	140	4	4-4-5	9							
		5	4-4-5	9				poor recovery, ironite pieces @ 8.5'			
10											
	135	6	3-3-4	7			CL	LEAN CLAY, trace sand, moist, brown	Potomac	B	
		7	3-4-5	9				trace roots @ 13.5'			
15								Bottom of Test Boring @ 15.0'			

TEST_BORING_LOG 14086.GPJ KOZERA.GDT 10/16/14

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: SWM-1
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 157.0
Date Started : 10-1-14
Date Completed : 10-1-14
Contractor : GeoServices Corp.
Driller : R. Stidham
Rig : cme 850 Auto
Drill Method : 2 1/4" HSA
Inspector : A. MacLeod

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	10-1	11:55	---	---	---
Completion	10-1	12:00	None	28.0	---
Casing Pulled	10-1	12:10	None	---	24.4
	10-2	11:10	None	---	23.7

Depth (ft)	Surf. Elev. 157.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0		1	4-7-7	14				silt, moist roots, rocks, FILL, brown	Fill	A	Topsoil = 0.2'
	155	2	3-4-4	8				clay FILL, roots, wood, topsoil, sticks, gray, moist, brown			
5		3	2-2-3	5				poor recovery @ 4.5'			
	150	4	2-2-2	4							
10		5	2-2-2	4							
	145	6	2-4-7	11				trace gravel @ 12.0'			
15		7	3-4-4	8							
	140	8	4-7-9	16			SM	SILTY SAND, moist, brown clay layer @ 18.0'	Potomac	B	
20		9	7-12-16	28			CL	LEAN CLAY, moist, brown some ironite @ 21.5 and 23.0'			
	135										
25		10	6-11-16	27			CH	FAT CLAY, moist, brown			
	130										
		11	11-16-16	32			SP	POORLY GRADED SAND, trace silt and silty sand layers, moist, brown			
30								Bottom of Test Boring @ 30.0'			

TEST_BORING_LOG 14086.GPJ KOZERA.GDT 10/16/14

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: SWM-2
Contract No.: 14086.D
Page: 1 of 1

Project: Eastern Family Resource Center
Location: Franklin Square Drive
Essex, Maryland

Ground Surf. El. (±) : 156.0
Date Started : 10-1-14
Date Completed : 10-1-14
Contractor : GeoServices Corp.
Driller : R. Stidham
Rig : cme 850 Auto
Drill Method : 2 1/4" HSA
Inspector : A. MacLeod

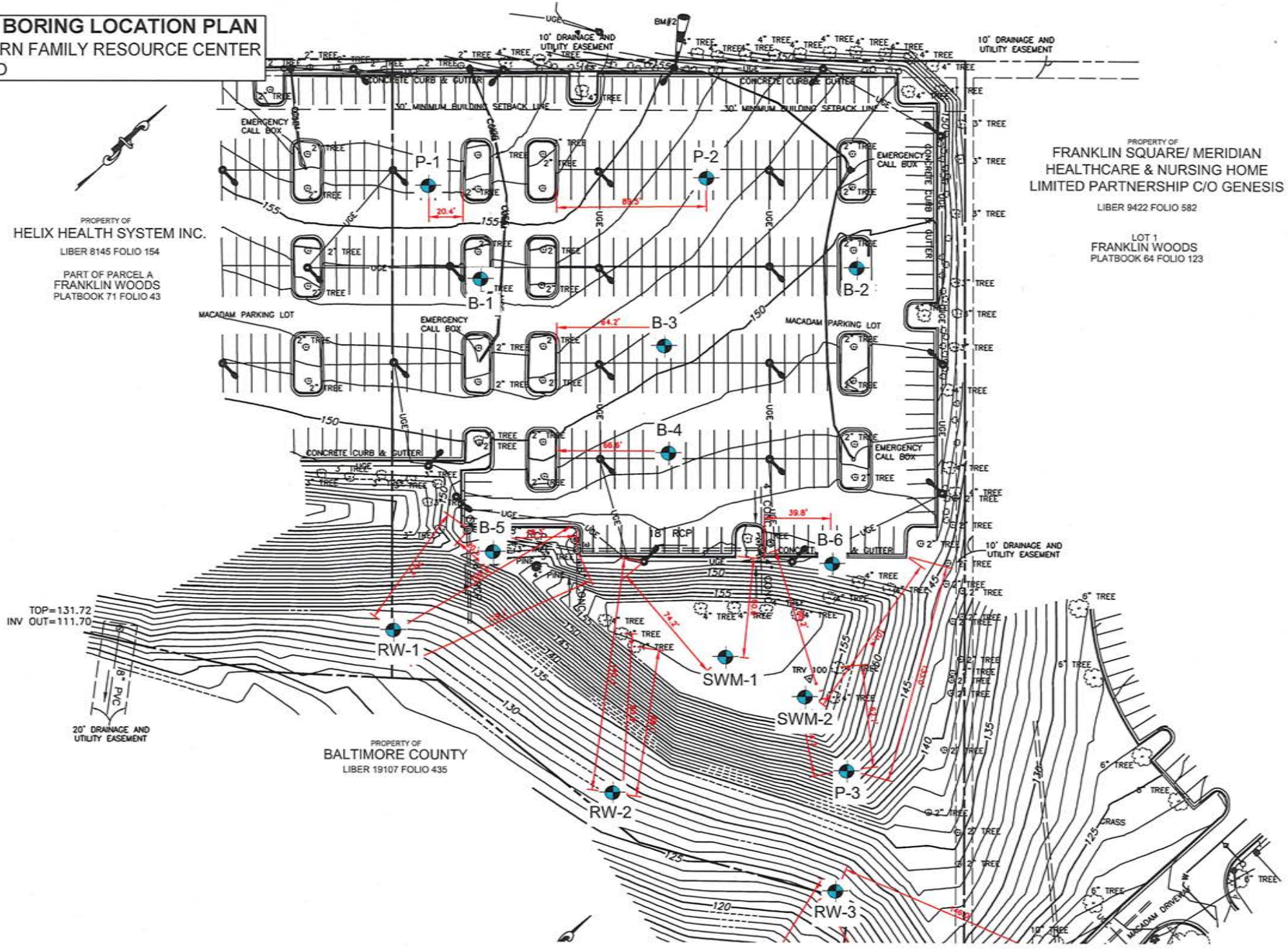
GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	10-1	09:00	---	---	---
Completion	10-1	09:05	None	28.5	---
Casing Pulled	10-1	09:15	None	---	24.9
	10-2	11:10	None	---	24.5

Depth (ft)	Surf. Elev. 156.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0	155	1	3-4-5	9				silt, clay, FILL, roots, moist	Fill	A	Topsoili = 0.1'
		2	3-6-6	12							
5	150	3	2-3-9	12				poor recovery @ 4.5' wood, topsoil, roots @ 4.5'			
		4	2-2-3	5				poor recovery @ 7.0'			
10	145	5	2-2-3	5							
		6	3-4-7	11				lean clay, FILL, moist, brown			
15	140	7	3-4-6	10							
		8	5-4-6	10			CL	LEAN CLAY, moist, brown	Potomac	B	
20	135	9	14-22-24	46			SP	POORLY GRADED SAND, some ironite, moist, brown			
25	130	10	9-13-13	26			SP	POORLY GRADED SAND, with silty sand layers, moist, brown			
		11	9-14-48	62				some ironite @ 29.0'			
30								Bottom of Test Boring @ 30.0'			

TEST_BORING_LOG 14086.GPJ KOZERA.GDT 10/16/14

TEST BORING LOCATION PLAN
EASTERN FAMILY RESOURCE CENTER
14086.D



D.W. KOZERA, INC.
PROFESSIONAL ENGINEERS AND GEOLOGISTS
1408 BARE HILLS ROAD, SUITE 200, BALTIMORE, MARYLAND 21209 (410) 823-1060

IN SITU INFILTRATION TEST

CONTRACT NO: 14086.D
TEST BORING NO: SWM- 1
PROJECT: North Point Development
LOCATION: Baltimore, Maryland

SURFACE ELEVATION: EL ~~[illegible]~~ 157±
DWK REPRESENTATIVE: A. MacLeod

DATE: 10-2-14
TEST DEVICE: 4" dia PVC Pipe
PIPE LENGTH: 30 ft
TEST DEPTH: 28 ft
EXCAVATION EQUIPMENT: CME 55
VISUAL SOIL CLASS: Silty SAND

TEST DATA

Date of presoak: 8-21-2014
Depth of presoak water after 24 hours 0.85 ft

Time	Interval (min)	Depth to top of water (ft.) *	Infiltration rate (ft/hr)**	Infiltration Rate (in/hr)
7:24	—	28.00	—	—
8:24	60	28.04	0.04	0.48
9:24	60	28.06	0.02	0.24
10:24	60	28.10	0.04	0.48
11:24	60	28.12	0.02	0.24
			AVG =	0.36 in/hr

* Measured from top of pipe

** Drop in water level (ft) / Interval (hr)

D.W. KOZERA, INC.
PROFESSIONAL ENGINEERS AND GEOLOGISTS
1408 BARE HILLS ROAD, SUITE 200, BALTIMORE, MARYLAND 21209 (410) 823-1060

IN SITU INFILTRATION TEST

CONTRACT NO: 14086.D
TEST BORING NO: SWM-2
PROJECT: North Point Development
LOCATION: Baltimore, Maryland

SURFACE ELEVATION: EL 158±
DWK REPRESENTATIVE: A. MacLeod

DATE: 10-2-14
TEST DEVICE: 4" dia PVC Pipe
PIPE LENGTH: 30 ft
TEST DEPTH: 27 ft
EXCAVATION EQUIPMENT: CME 55
VISUAL SOIL CLASS: Silty Sands

TEST DATA

Date of presoak: 8-21-2014
Depth of presoak water after 24 hours 0.30 Ft

Time	Interval (min)	Depth to top of water (ft.) *	Infiltration rate (ft/hr)**	Infiltration Rate (in/hr)
7:27	—	27.92	—	—
8:27	60	27.96	0.04	0.48
9:27	60	28.00	0.04	0.48
10:27	60	28.04	0.04	0.48
11:27	60	28.08	0.04	0.48
			Avg =	0.48 in/hr

* Measured from top of pipe

** Drop in water level (ft) / Interval (hr)

APPENDIX B

Soil Laboratory Testing

SUMMARY OF LABORATORY TESTING

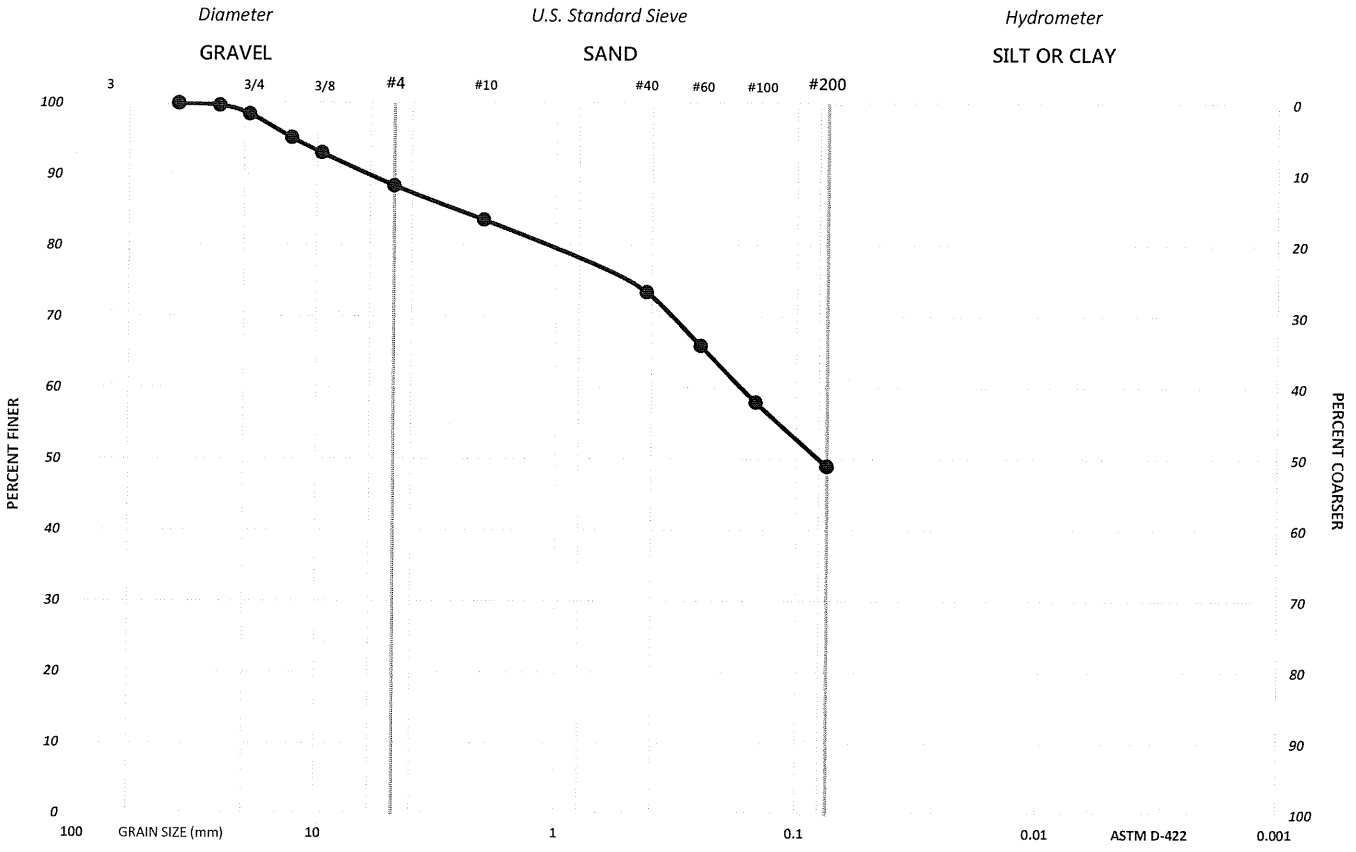
EASTERN FAMILY RESOURCE CTR

PROJECT #:	14086.D	**SAMPLED:**	-	**JAY KAY TESTING**
SAMPLES:	2	**LOCATION:**	*Baltimore, MD*	5233 Lehman Road, Suite 110
REPORT:	09/30/14	**REMARKS:**	-	Spring Grove, PA 17362
				Phone: (410) 259-5101

BORING	SAMPLE	DEPTH	MC %	OM %	LL	PL	PI	% FINES	USCS
P-1	Bulk	0-5.0	16.0	-	35	21	14	49.0	SC
P-2	Bulk	0-5.0	15.9	-	38	23	15	49.8	SC
Jay Kay Testing (AASHTO-Accredited)									

EASTERN FAMILY RESOURCE CTR

BORING:	**P-1**	PROJECT #:	14086.D	**JAY KAY TESTING**
SAMPLE:	**Bulk**	SAMPLED:	-	5233 Lehman Road, Suite 110
DEPTH:	**0-5.0'**	LOCATION:	*Baltimore, MD*	Spring Grove, PA 17362
				Phone: (410) 259-5101



GRAIN SIZE ANALYSIS

Diameter	75.0	50.8	37.5	25.4	19.0	12.7	9.51	4.75	2.0	0.42	0.25	0.147	0.074
Sieve Size	3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#60	#100	**# 200**
% Passing	-	-	100.0	99.7	98.5	95.2	93.1	88.4	83.7	73.5	66.0	58.0	**49.0**

% GRAVEL	% SAND	Coarse Gravel	Fine Gravel	Coarse Sand	Medium Sand	Fine Sand	CC	CU
11.6	**39.4**	1.5	10.1	4.7	10.2	24.5	-	-

Moisture Content	16.0	Organic Content	-
pH	-	Other	-

ATTERBERG LIMITS

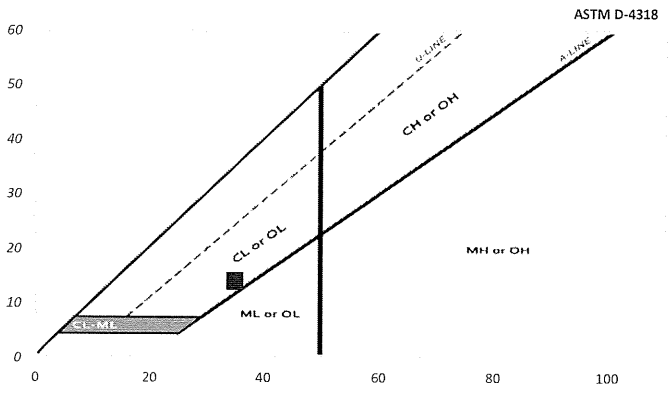
Liquid Limit	35
Plastic Limit	21
Plasticity Index	14

CLASSIFICATION

AASHTO	A-6
USCS	SC

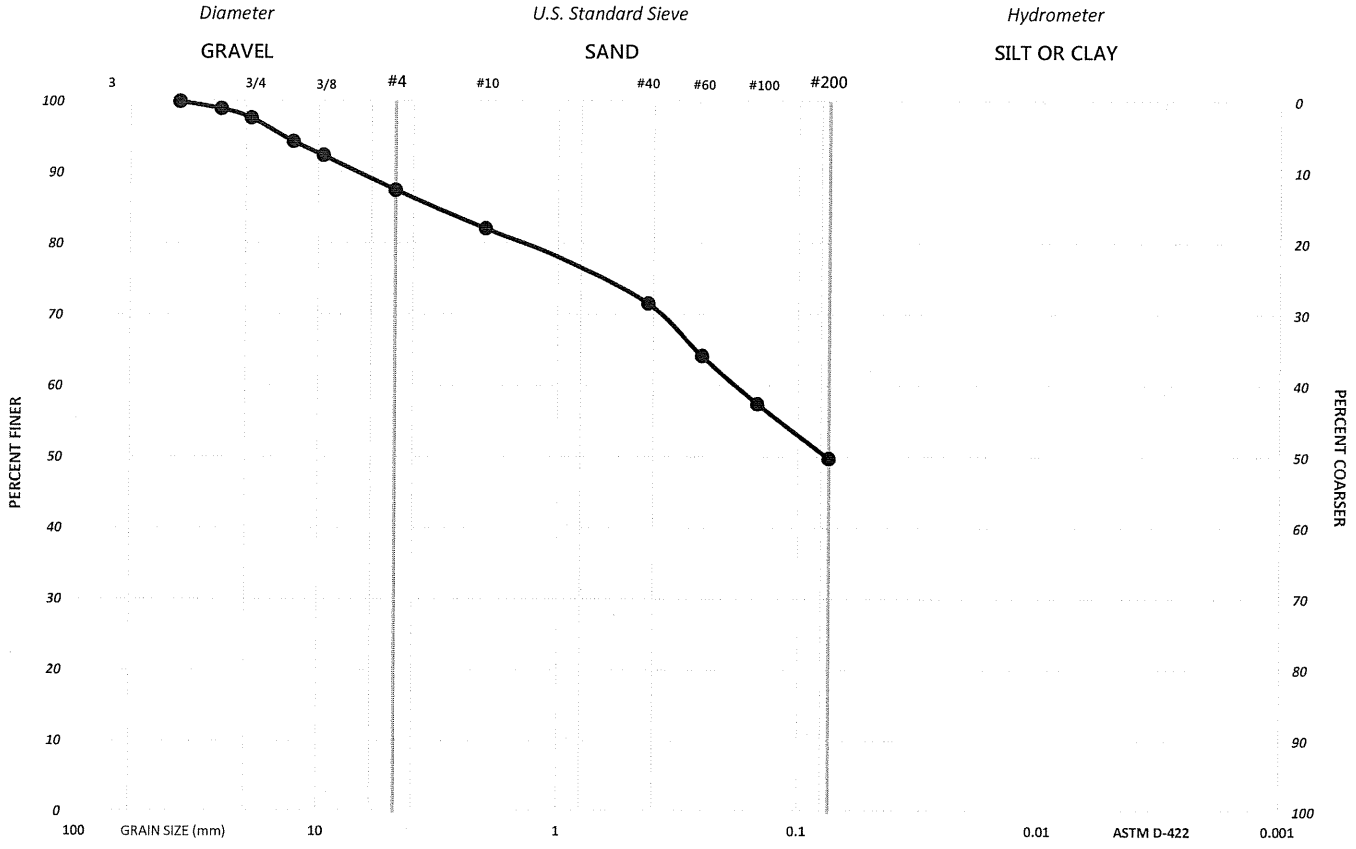
SOIL DESCRIPTION

Brown clayey SAND



EASTERN FAMILY RESOURCE CTR

BORING:	**P-2**	PROJECT #:	14086.D	**JAY KAY TESTING**
SAMPLE:	**Bulk**	SAMPLED:	-	5233 Lehman Road, Suite 110
DEPTH:	**0-5.0'**	LOCATION:	*Baltimore, MD*	Spring Grove, PA 17362
				Phone: (410) 259-5101



GRAIN SIZE ANALYSIS

Diameter	75.0	50.8	37.5	25.4	19.0	12.7	9.51	4.75	2.0	0.42	0.25	0.147	0.074
Sieve Size	3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#60	#100	**# 200**
% Passing	-	-	100.0	99.0	97.7	94.4	92.4	87.6	82.1	71.6	64.2	57.5	**49.8**

% GRAVEL	% SAND	Coarse Gravel	Fine Gravel	Coarse Sand	Medium Sand	Fine Sand	CC	CU
12.4	**37.8**	2.3	10.1	5.5	10.5	21.8	-	-

Moisture Content	15.9	Organic Content	-
pH	-	Other	-

ATTERBERG LIMITS

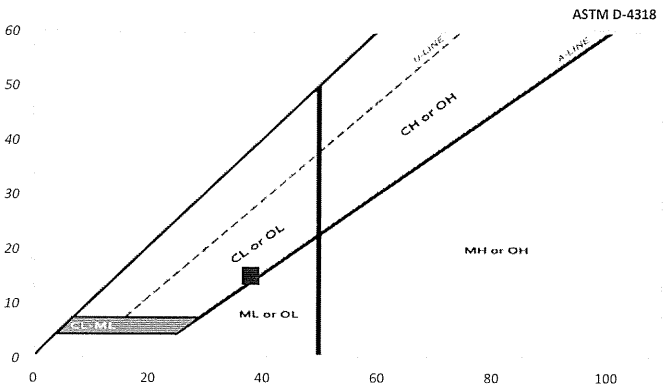
Liquid Limit	38
Plastic Limit	23
Plasticity Index	15

CLASSIFICATION

AASHTO	A-6
USCS	SC

SOIL DESCRIPTION

Brown clayey SAND



EASTERN FAMILY RESOURCE CTR

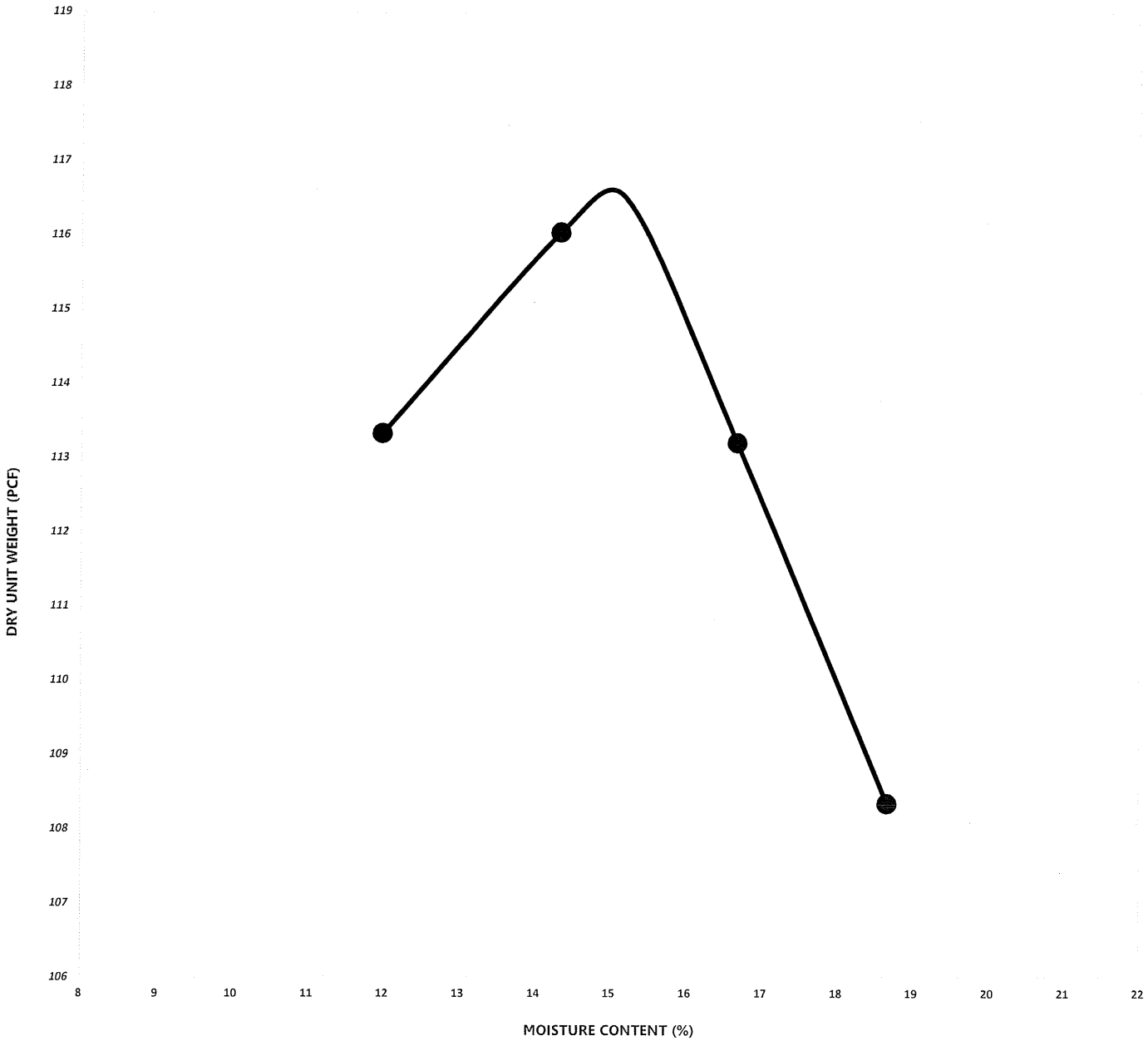
BORING:	**P-1**	PROJECT #:	14086.D	**JAY KAY TESTING**
SAMPLE:	**Bulk**	SAMPLED:	-	5233 Lehman Road, Suite 110
DEPTH:	**0-5.0'**	LOCATION:	*Baltimore, MD*	Spring Grove, PA 17362
				Phone: (410) 259-5101

STANDARD PROCTOR TEST RESULTS

TEST METHOD: ASTM D-698 (B)

*Corrected for 6.9% retained on 3/8" sieve

	UNCORRECTED		CORRECTED *
Maximum Dry Unit Weight	116.5	PCF	118.8
Optimum Moisture Content	15.2	MC	14.3



MC	LL	PL	PI	USCS	AASHTO	FINES	SOIL DESCRIPTION
16.0	35	21	14	SC	A-6	49.0	Brown clayey SAND

EASTERN FAMILY RESOURCE CTR

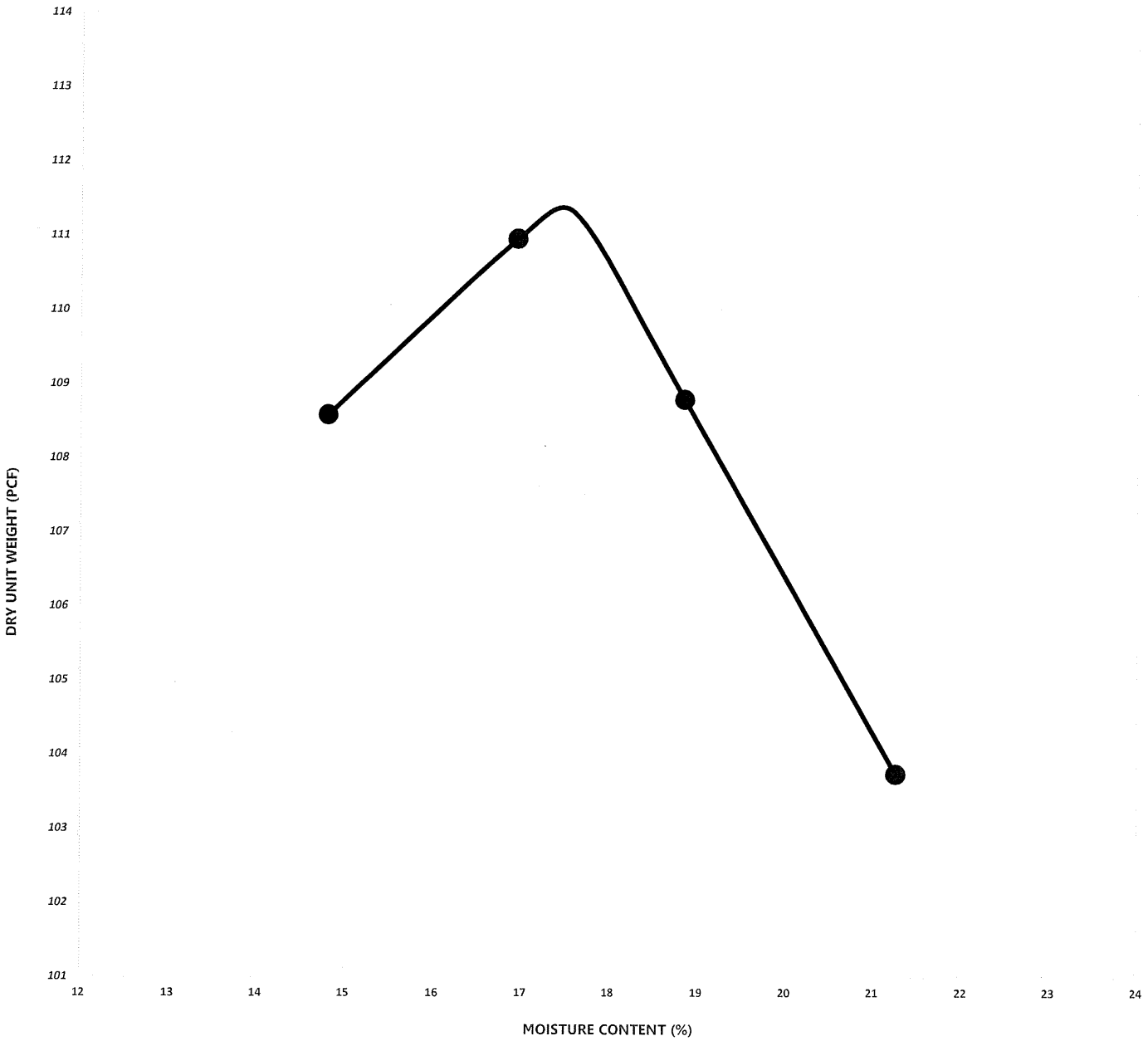
BORING:	**P-2**	PROJECT #:	14086.D	**JAY KAY TESTING**
SAMPLE:	**Bulk**	SAMPLED:	-	5233 Lehman Road, Suite 110
DEPTH:	**0-5.0'**	LOCATION:	*Baltimore, MD*	Spring Grove, PA 17362
				Phone: (410) 259-5101

STANDARD PROCTOR TEST RESULTS

TEST METHOD: ASTM D-698 (B)

*Corrected for 7.6% retained on 3/8" sieve

	UNCORRECTED		CORRECTED *
Maximum Dry Unit Weight	111.3	PCF	114.0
Optimum Moisture Content	17.6	MC	16.4



MC	LL	PL	PI	USCS	AASHTO	FINES	SOIL DESCRIPTION
15.9	38	23	15	SC	A-6	49.8	Brown clayey SAND

EASTERN FAMILY RESOURCE CTR

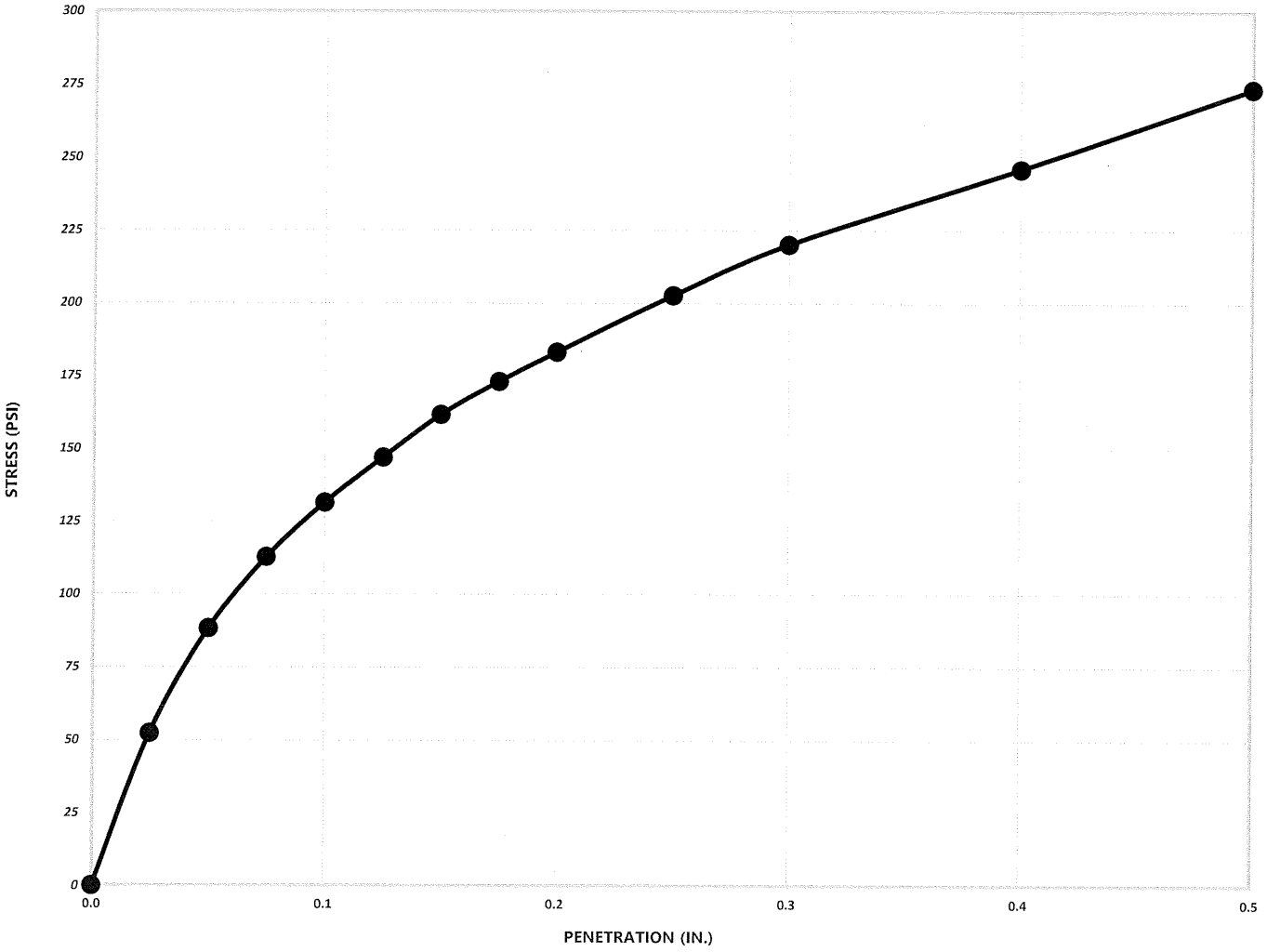
Boring:	**P-1**	Project No.:	14086.D	**JAY KAY TESTING**
Sample:	**Bulk**	Sampled:	-	5233 Lehman Road, Suite 110
Depth:	**0-5.0'**	Location:	*Baltimore, MD*	Spring Grove, PA 17362
				Phone: (410) 259-5101

CALIFORNIA BEARING RATIO TEST RESULTS

CBR AT 0.1"	CBR AT 0.2"
13.2	12.2

	Dry Unit Weight	Moisture Content	Compaction	Swell	Surcharge
As Molded	112.7	15.2	94.9	-	75
After Soak	-	-	-	0.41	75
	PCF	%	%	%	PSF

METHOD: ASTM D-1883, COMPACTION: ASTM D-698 (B)



MC	LL	PL	PI	USCS	AASHTO	FINES	SOIL DESCRIPTION
16.0	35	21	14	SC	A-6	49.0	Brown clayey SAND

EASTERN FAMILY RESOURCE CTR

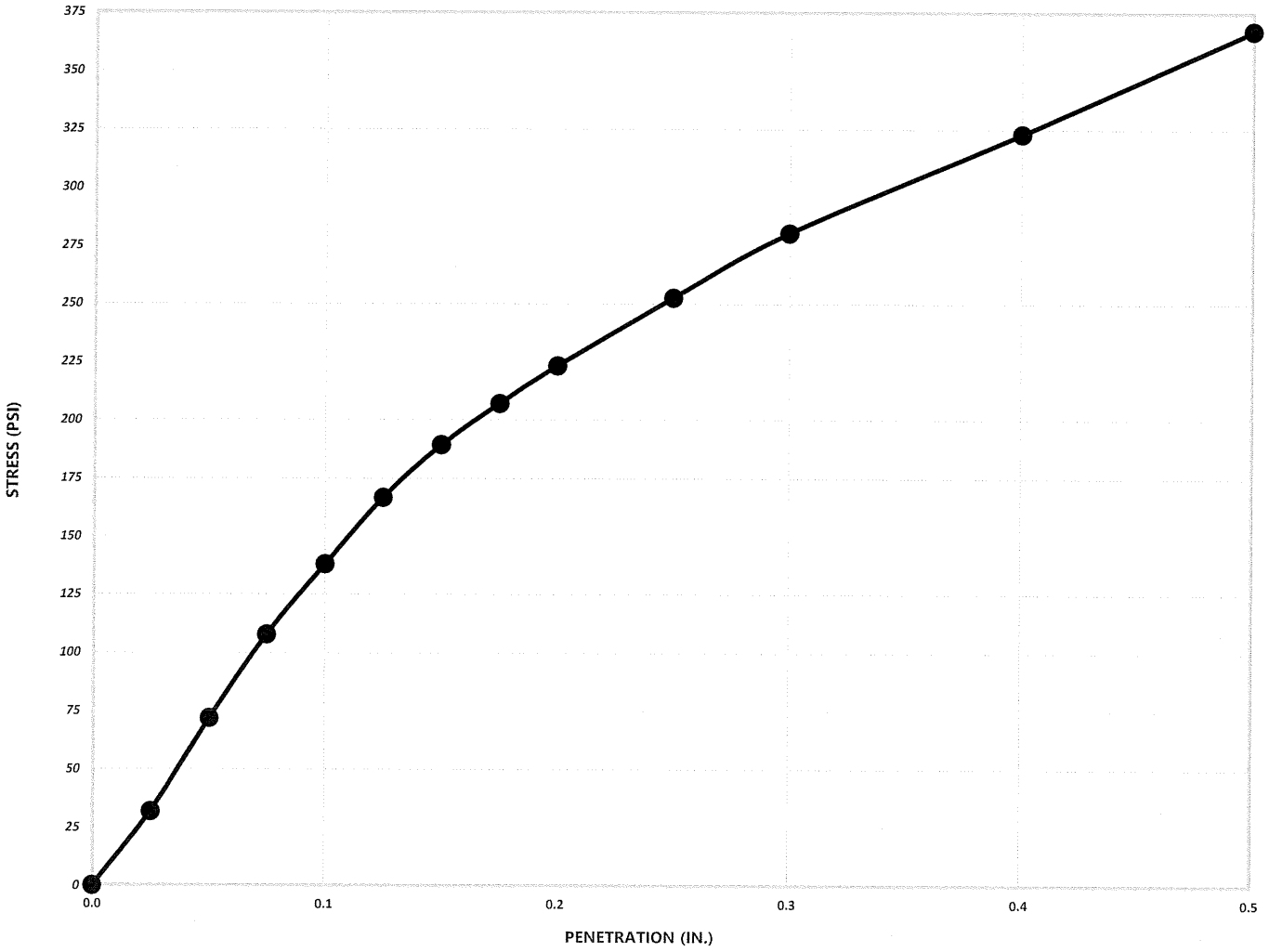
Boring:	**P-2**	Project No.:	14086.D	**JAY KAY TESTING**
Sample:	**Bulk**	Sampled:	-	5233 Lehman Road, Suite 110
Depth:	**0-5.0'**	Location:	*Baltimore, MD*	Spring Grove, PA 17362
				Phone: (410) 259-5101

CALIFORNIA BEARING RATIO TEST RESULTS

CBR AT 0.1"	CBR AT 0.2"
13.8	14.9

	Dry Unit Weight	Moisture Content	Compaction	Swell	Surcharge
As Molded	110.2	17.3	96.6	-	75
After Soak	-	-	-	0.26	75
	PCF	%	%	%	PSF

METHOD: ASTM D-1883, COMPACTION: ASTM D-698 (B)



MC	LL	PL	PI	USCS	AASHTO	FINES	SOIL DESCRIPTION
15.9	38	23	15	SC	A-6	49.8	Brown clayey SAND

SUMMARY OF LABORATORY TESTING

EASTERN FAMILY RESOURCE CENTER

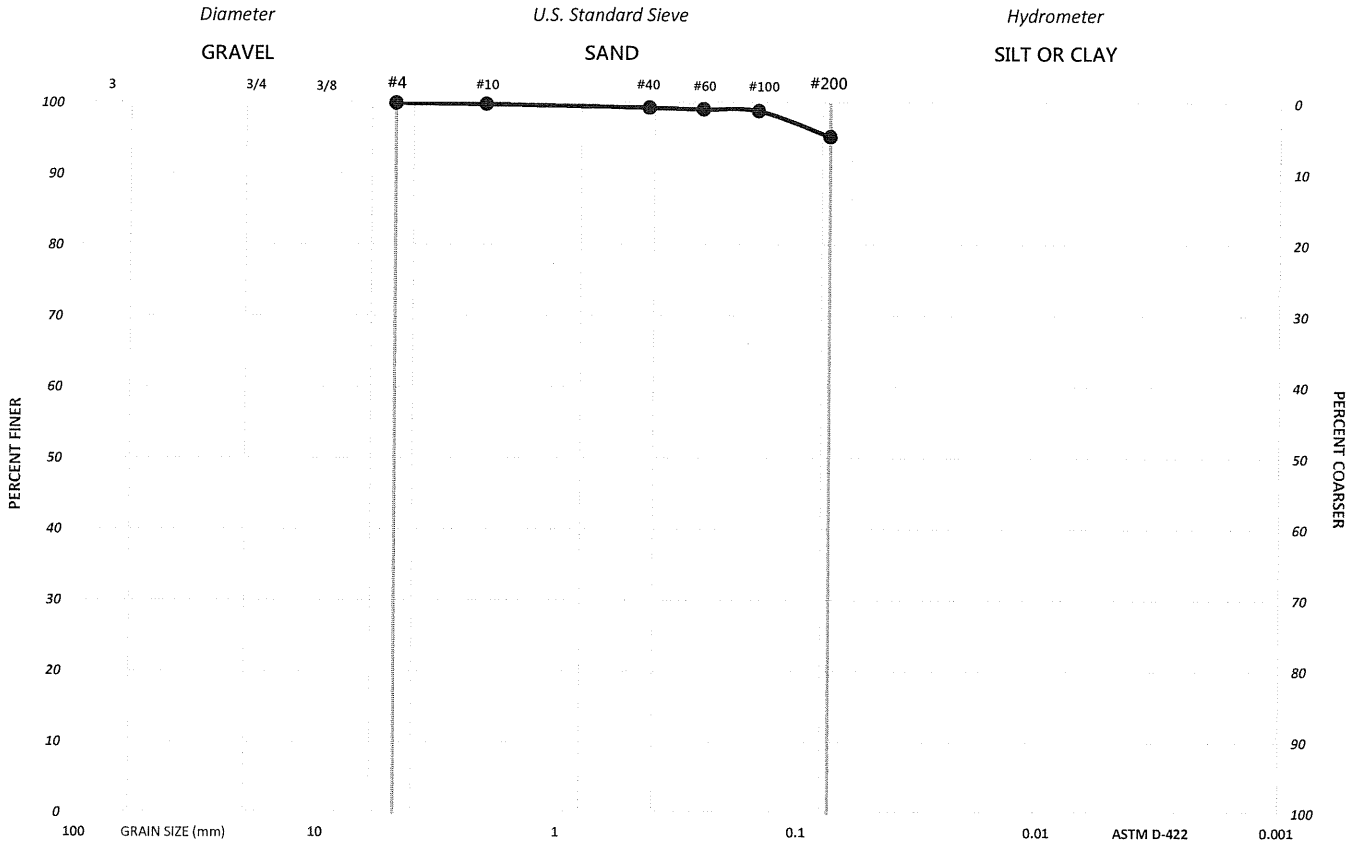
PROJECT #:	14086.D	**SAMPLED:**	-	**JAY KAY TESTING**
SAMPLES:	12	**LOCATION:**	*Baltimore, MD*	5233 Lehman Road, Suite 110
REPORT:	10/07/14	**REMARKS:**	-	Spring Grove, PA 17362
				Phone: (410) 259-5101

BORING	SAMPLE	DEPTH	MC %	OM %	LL	PL	PI	% FINES	USCS
B-1	Jar	9.0	14.2	-	-	-	-	-	-
B-1	Jar	14.0	19.8	-	-	-	-	-	-
B-1	Jar	19.0	19.5	-	-	-	-	-	-
B-3	Jar	4.0	20.5	-	51	27	24	-	-
B-3	Jar	6.5	20.0	-	43	25	18	-	-
B-4	Jar	9.0	19.6	-	40	21	19	95.3	CL
B-6	Jar	4.0	22.9	-	-	-	-	-	-
P-3	Jar	11.0	21.3	-	40	22	18	85.3	CL
RW-2	Jar	4.5	15.0	-	21	20	1	25.2	SM
SWM-1	Jar	7.0	22.5	3.90	31	20	11	67.4	CL
SWM-1	Jar	28.0	8.3	-	-	-	-	-	-
SWM-2	Jar	28.5	1.9	-	-	-	-	-	-

Jay Kay Testing (AASHTO-Accredited)

EASTERN FAMILY RESOURCE CENTER

BORING:	**B-4**	PROJECT #:	14086.D	**JAY KAY TESTING**
SAMPLE:	**Jar**	SAMPLED:	-	5233 Lehman Road, Suite 110
DEPTH:	**9.0'**	LOCATION:	*Baltimore, MD*	Spring Grove, PA 17362
				Phone: (410) 259-5101



GRAIN SIZE ANALYSIS

Diameter	75.0	50.8	37.5	25.4	19.0	12.7	9.51	4.75	2.0	0.42	0.25	0.147	0.074
Sieve Size	3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#60	#100	**# 200**
% Passing	-	-	-	-	-	-	-	100.0	99.9	99.3	99.1	98.9	**95.3**

% GRAVEL	% SAND	Coarse Gravel	Fine Gravel	Coarse Sand	Medium Sand	Fine Sand	CC	CU
-	**4.7**	-	-	0.1	0.6	4.0	-	-

Moisture Content	19.6	Organic Content	-
pH	-	Other	-

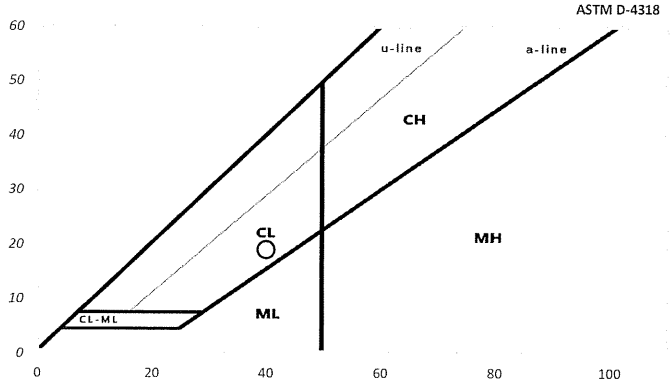
ATTERBERG LIMITS

Liquid Limit	40
Plastic Limit	21
Plasticity Index	19

CLASSIFICATION

AASHTO	A-6
USCS	CL

ASTM D-4318

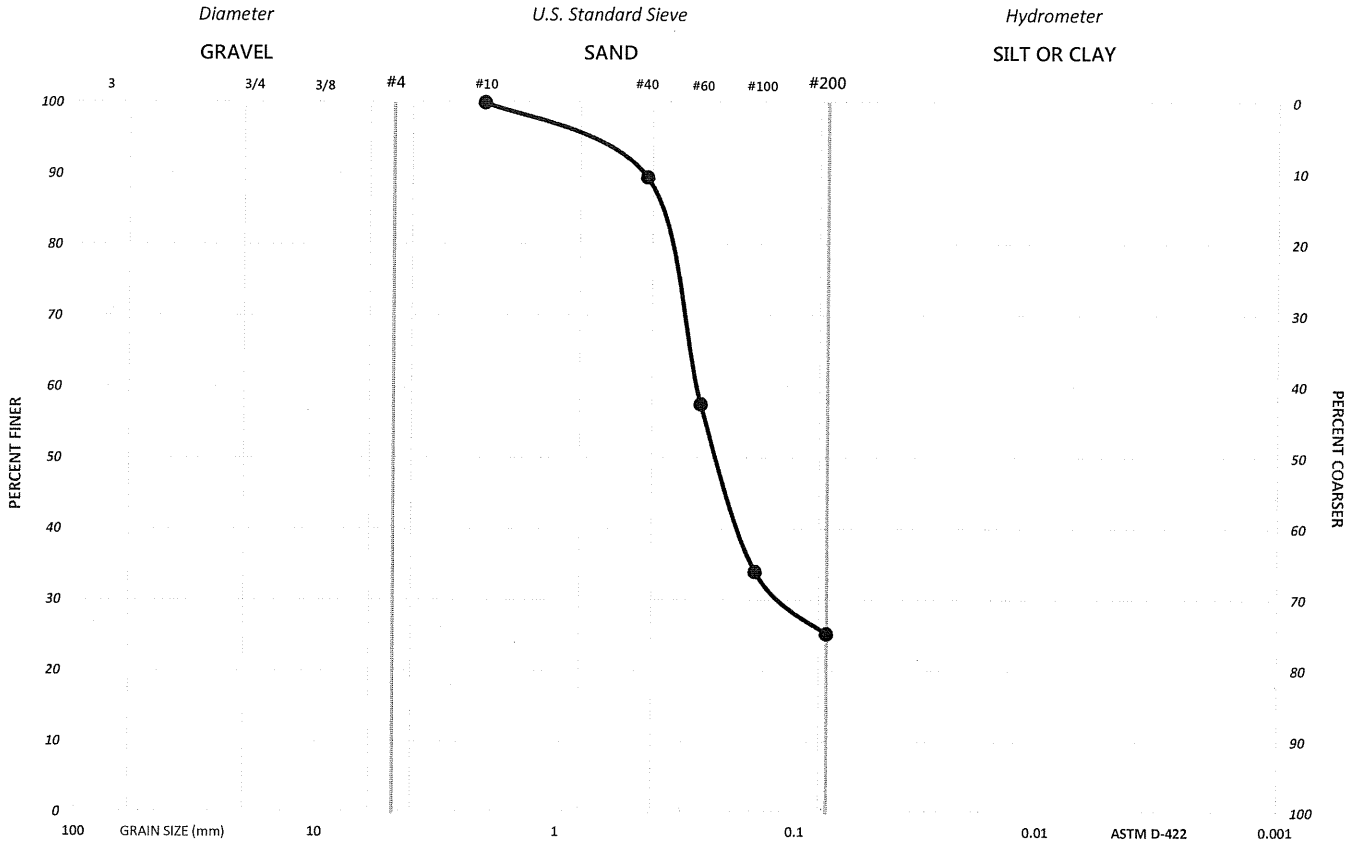


SOIL DESCRIPTION

Light brown lean CLAY

EASTERN FAMILY RESOURCE CENTER

BORING:	**RW-2**	PROJECT #:	14086.D	**JAY KAY TESTING**
SAMPLE:	**Jar**	SAMPLED:	-	5233 Lehman Road, Suite 110
DEPTH:	**4.5'**	LOCATION:	*Baltimore, MD*	Spring Grove, PA 17362
				Phone: (410) 259-5101



GRAIN SIZE ANALYSIS

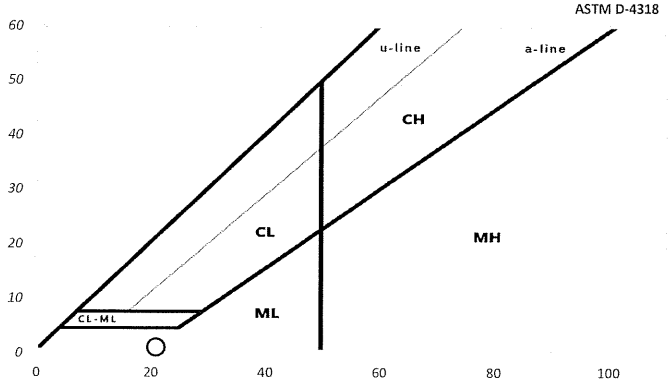
Diameter	75.0	50.8	37.5	25.4	19.0	12.7	9.51	4.75	2.0	0.42	0.25	0.147	0.074
Sieve Size	3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#60	#100	**# 200**
% Passing	-	-	-	-	-	-	-	-	100.0	89.5	57.6	34.0	**25.2**

% GRAVEL	% SAND	Coarse Gravel	Fine Gravel	Coarse Sand	Medium Sand	Fine Sand	CC	CU
-	**74.8**	-	-	-	10.5	64.3	-	-

Moisture Content	15.0	Organic Content	-
pH	-	Other	-

ATTERBERG LIMITS		CLASSIFICATION	
Liquid Limit	21	AASHTO	A-2-4
Plastic Limit	20	USCS	SM
Plasticity Index	1		

ASTM D-4318

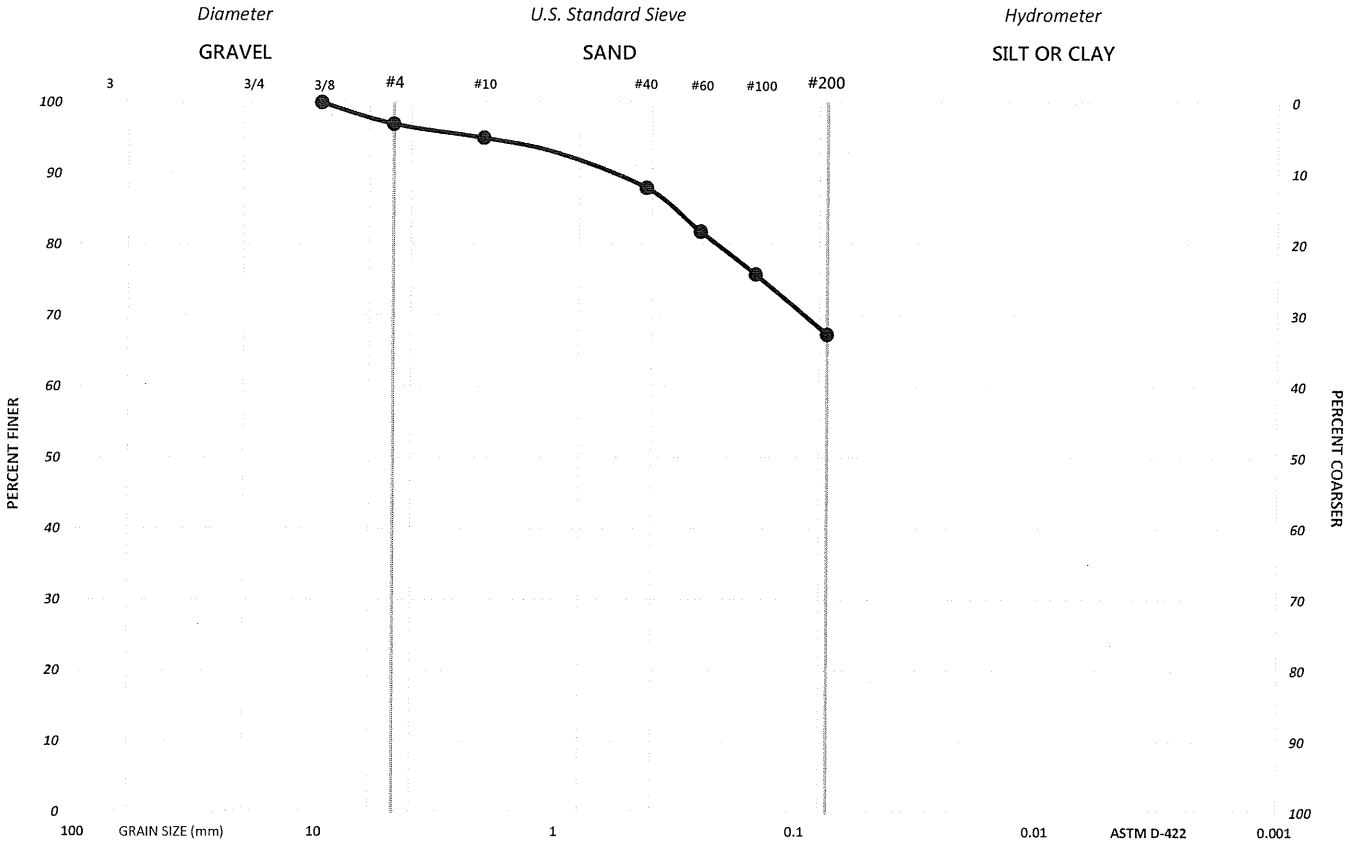


SOIL DESCRIPTION

Orange brown silty SAND

EASTERN FAMILY RESOURCE CENTER

BORING:	**SWM-1**	PROJECT #:	14086.D	**JAY KAY TESTING**
SAMPLE:	**Jar**	SAMPLED:	-	5233 Lehman Road, Suite 110
DEPTH:	**7.0'**	LOCATION:	*Baltimore, MD*	Spring Grove, PA 17362
				Phone: (410) 259-5101



GRAIN SIZE ANALYSIS

Diameter	75.0	50.8	37.5	25.4	19.0	12.7	9.51	4.75	2.0	0.42	0.25	0.147	0.074
Sieve Size	3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#60	#100	**# 200**
% Passing	-	-	-	-	-	-	100.0	97.0	95.0	88.0	81.9	75.8	**67.4**

% GRAVEL	% SAND	Coarse Gravel	Fine Gravel	Coarse Sand	Medium Sand	Fine Sand	CC	CU
3.0	**29.6**	-	3.0	2.0	7.0	20.6	-	-

Moisture Content	22.5	Organic Content	3.90
pH	-	Other	-

ATTERBERG LIMITS

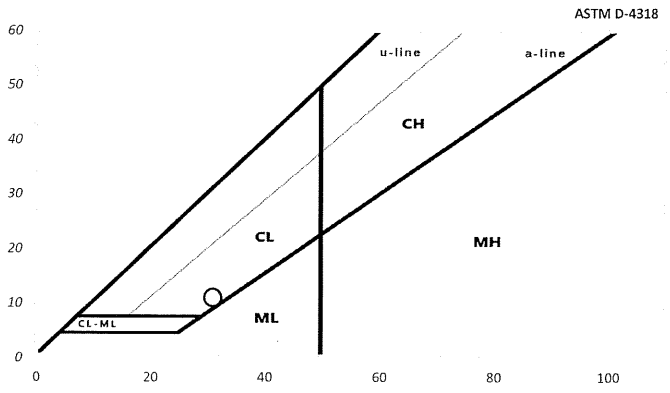
Liquid Limit	31
Plastic Limit	20
Plasticity Index	11

CLASSIFICATION

AASHTO	A-6
USCS	CL

SOIL DESCRIPTION

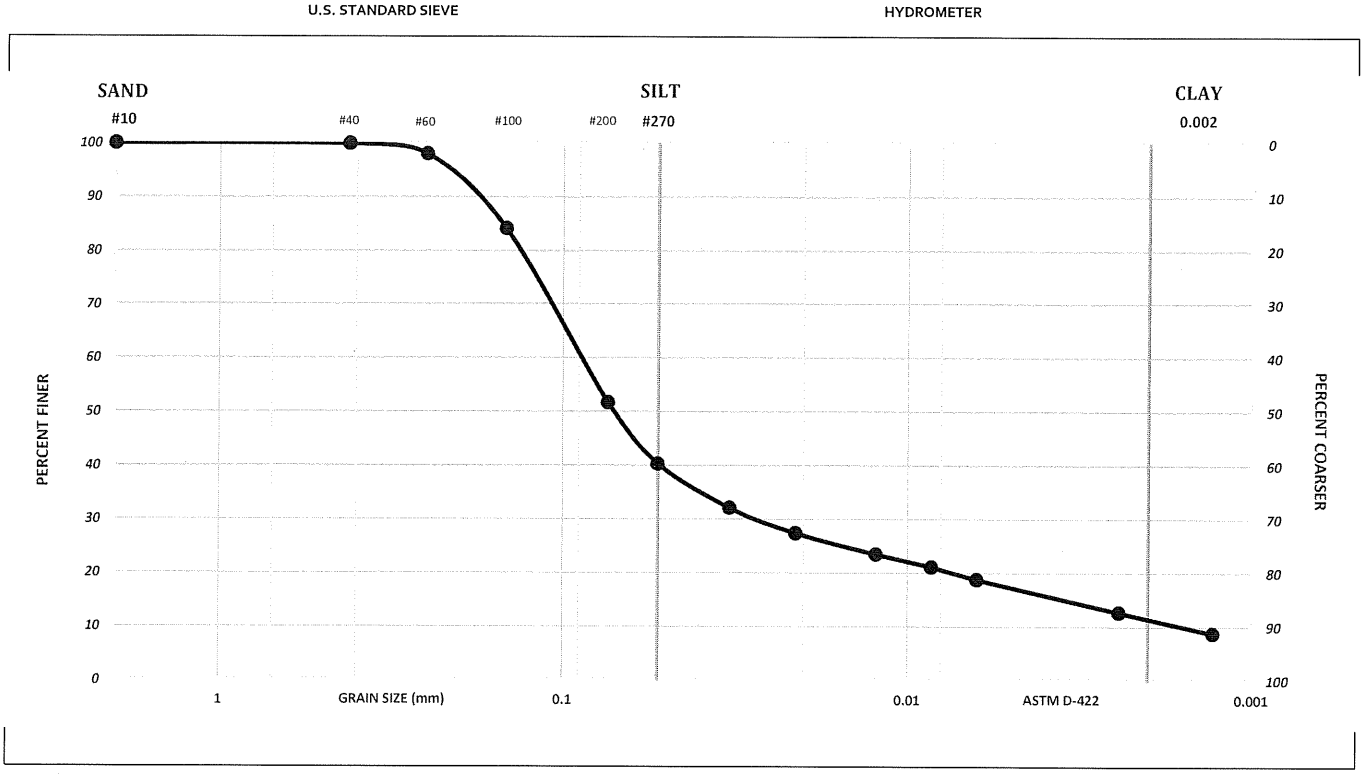
Dark brown sandy lean CLAY

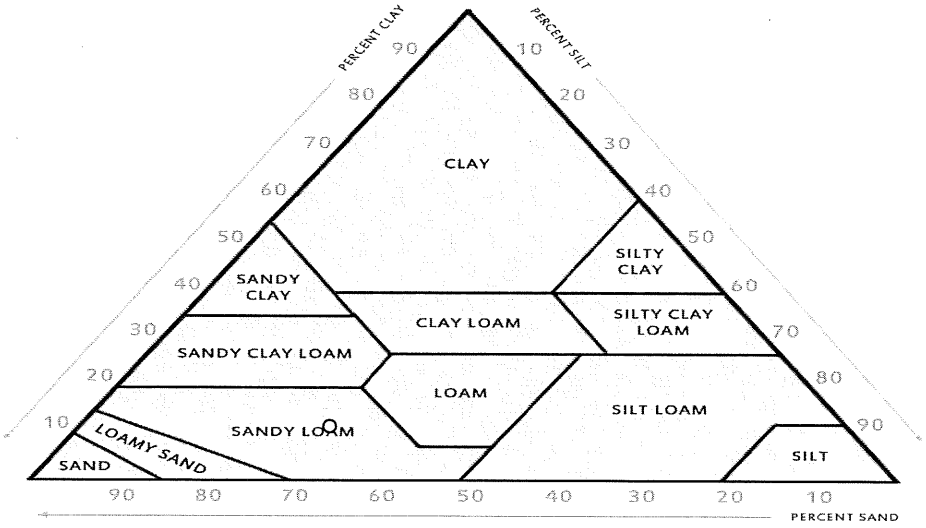


EASTERN FAMILY RESOURCE CENTER

BORING:	**SWM-1**	PROJECT #:	14086.D	**JAY KAY TESTING**
SAMPLE:	**Jar**	SAMPLED:	-	5233 Lehman Road, Suite 110
DEPTH:	**28.0'**	LOCATION:	*Baltimore, MD*	Spring Grove, PA 17362
				Phone: (410) 259-5101

USDA RESULTS





PERCENT SAND

59.6 %

PERCENT SILT

29.0 %

PERCENT CLAY

11.4 %

USDA CLASSIFICATION

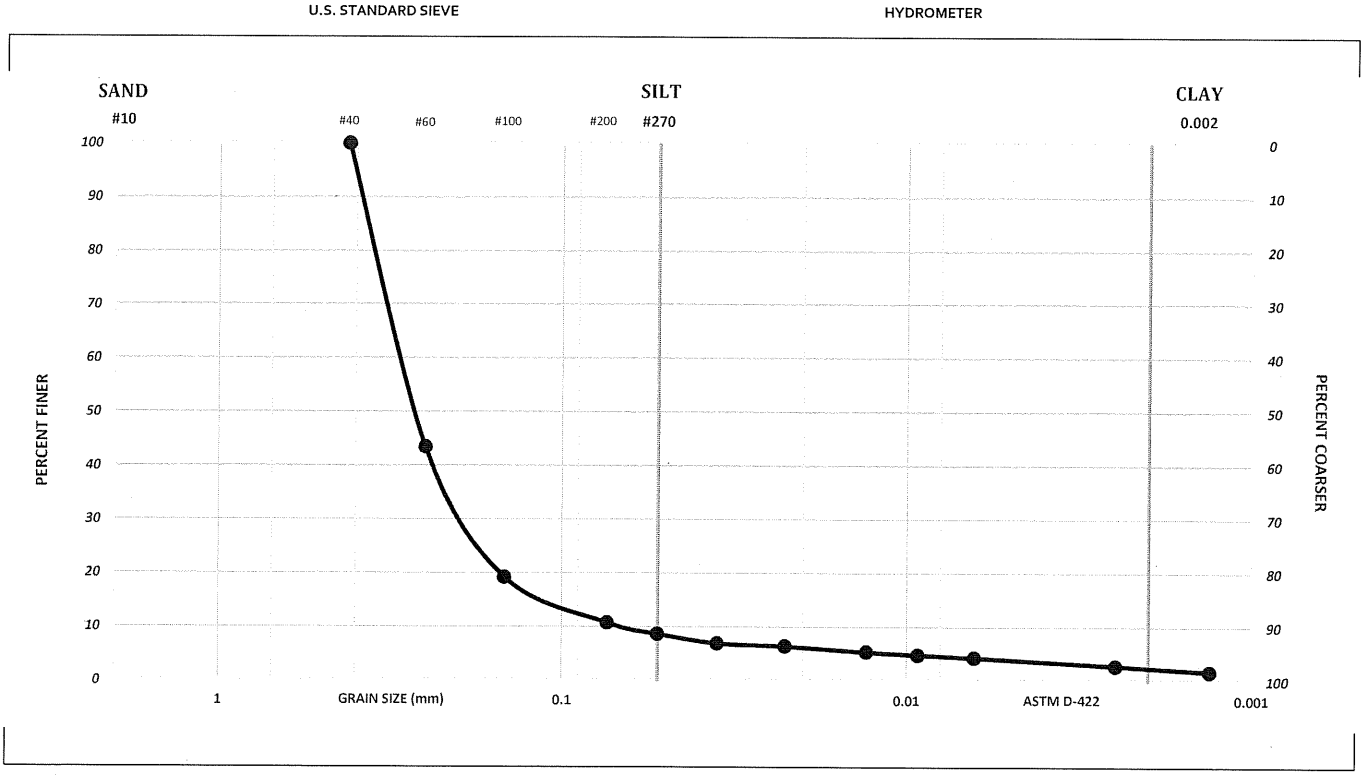
SANDY LOAM

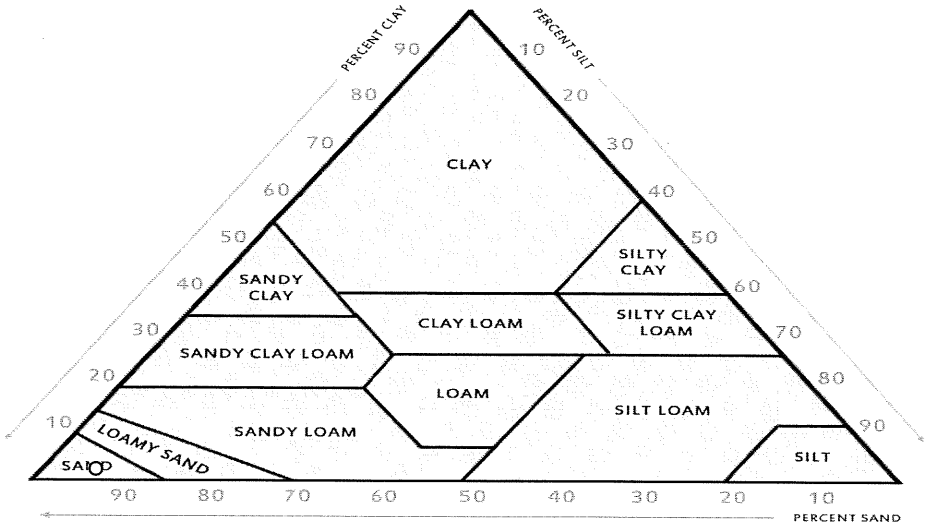
MC	LL	PL	PI	USCS	AASHTO
8.3	-	-	-	-	-

EASTERN FAMILY RESOURCE CENTER

BORING:	**SWM-2**	PROJECT #:	14086.D	**JAY KAY TESTING**
SAMPLE:	**Jar**	SAMPLED:	-	5233 Lehman Road, Suite 110
DEPTH:	**28.5'**	LOCATION:	*Baltimore, MD*	Spring Grove, PA 17362
				Phone: (410) 259-5101

USDA RESULTS





PERCENT SAND

91.3 %

PERCENT SILT

6.5 %

PERCENT CLAY

2.2 %

USDA CLASSIFICATION

SAND

MC	LL	PL	PI	USCS	AASHTO
1.9	-	-	-	-	-

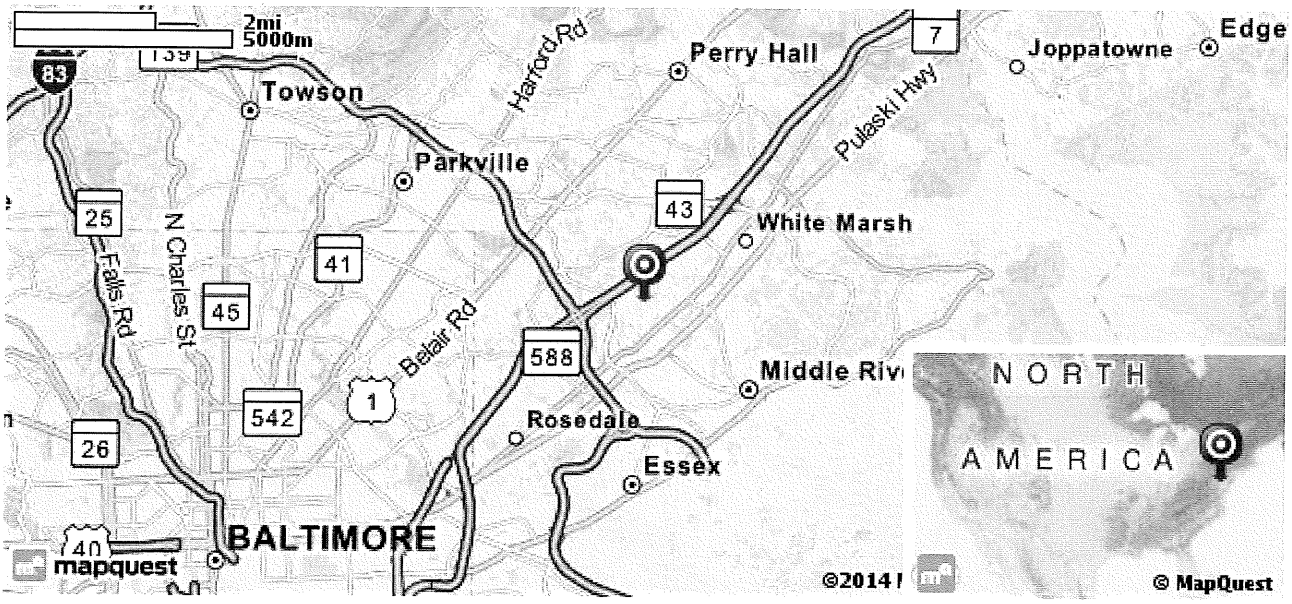
APPENDIX C

Spectral Acceleration Response

USGS Design Maps Summary Report

User–Specified Input

Report Title	Eastern Family Resource Center Mon October 6, 2014 19:07:04 UTC
Building Code Reference Document	2012 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	39.3545°N, 76.4747°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

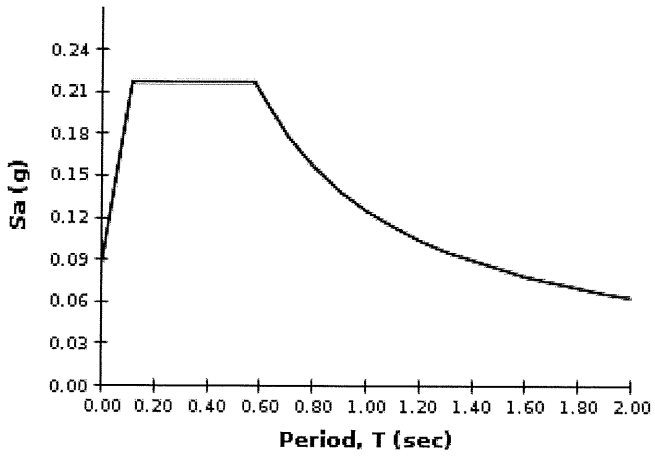


USGS–Provided Output

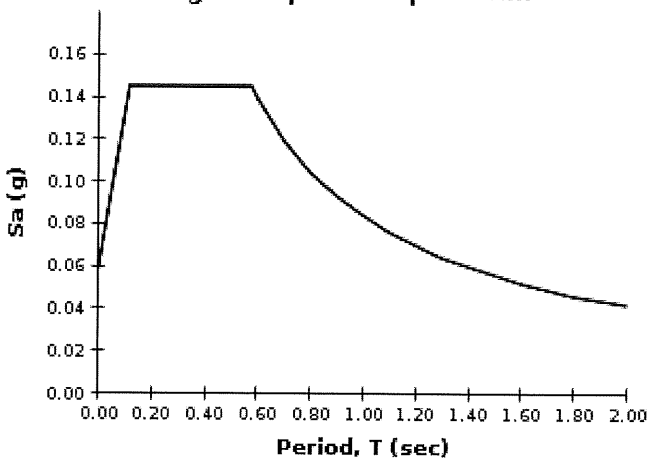
S_S =	0.136 g	S_{MS} =	0.217 g	S_{DS} =	0.145 g
S_1 =	0.052 g	S_{M1} =	0.125 g	S_{D1} =	0.084 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

MCE_R Response Spectrum



Design Response Spectrum



DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 10 00

SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Owner-furnished products.
4. Access to site.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and drawing conventions.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Eastern Family Resource Center

1. Project Location: 9150 Franklin Square Dr, Baltimore, MD 21237

B. Owner: Baltimore County Property Management

1. Owner's Representative: Dan Schindler; 12200A Long Green Pike, Glen Arm, MD 21057; Phone: 410-887-8666

C. Architect: Hord Coplan Macht, Inc., 750 East Pratt Street, Suite 1100, Baltimore, MD 21202; Phone: 410-837-7311.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. The Eastern Family Resource Center will be a new 3-story LEED Silver Certified Baltimore County Building of approximately 80,000 square feet. Occupancy types per IBC 2012 include B, R-2, I-4, A-3, and S-1. The ground floor will house a 250-bed

homeless shelter for Women and Families. The ground floor will also house administrative offices for the shelter, activity spaces and a licensed day care. The upper two floors will accommodate additional housing and a variety of clinical and social services for Baltimore County residents. The second floor will house a 50 bed shelter for single men and the third floor will provide space as transitional housing for up to 38 people. The clinical and social services on floors 2 and 3 include those with the county's Health Department such as Behavioral Health; Women Infants and Children; Infants and Toddlers; Speech Language and Hearing; Family Planning; and a Dental Clinic. A Health Care for the Homeless component is also provided.

The building will be IIB construction per IBC 2012, with a steel framed structure and masonry veneer over a combination of masonry and metal stud walls. Thermally broken aluminum storefront and aluminum windows will serve as window openings. Primary air handling units will be housed within a rooftop penthouse. Roofing will primarily consist of low slope, adhered TPO roof membrane with an extensive vegetative roofing system.

B. Type of Contract: Project will be constructed under a single prime contract.

1.5 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, and protecting Owner-furnished products.

B. Owner-Furnished Products:

1. Ceiling projector mounts.

2. Brackets for TV's, monitors and computers.

1.6 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.7 COORDINATION WITH OCCUPANTS

A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 6:30 a.m. to 4 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: As negotiated with owner.

2. Any work involved with the existing parking lot to be coordinated with Baltimore County Property Management at least 14 days in advance.

C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than 5 days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

D. Nonsmoking Campus: Smoking on the Owner’s property is not permitted.

E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

F. Parking: All parking to be restricted to the construction site. No parking on/at the adjacent properties, including the hospital, nursing home, and college.

G. Security Procedures

1. Contractor to establish and maintain a system to monitor Contractor’s direct and indirect employees who will have access to work areas.
2. Contractor to submit security plan for review and approval by Owner prior to commencement of work.
3. Contractor to provide contractor badges for all personnel (including subcontractor personnel) and require that badges be visible. Contractor to keep an up-to-date log of all personnel.

H. Control of Personnel: Contractor to enforce the following requirments.

1. Food and beverages shall not be consumed within finished or partially finished areas of building.

2. Smoking and tobacco products are prohibited.
3. Radios, tape players, mp3 players, iPods, and similar devices are prohibited from use in work areas, except two-way radios for business use when specifically approved by Owner.

I. Safety

1. Contractor is responsible for safety on the job site at all times. Contractor shall take the appropriate actions to assure the area of construction is secured. Contractor shall construct and/or install temporary fencing, signs, and barricades as required to assure a safe and secure environment. The Contractor is required to remove and dispose of all Contractor-installed safety/secuirty items as soon as they are no longer needed.

2. The Contractor is required to remove and dispose of all Contractor-installed temporary utilities as soon as they are no longer needed.

3. Contractor shall maintain work areas in a broom-clean and orderly condition and will be responsible for clean-up and removal of debris on a daily basis. If, in the opinion of the Owner, clean-up is not being performed satisfactorily, the Owner shall, after 24 hours of having notified the Contractor of the same, have the work performed by others and all charges incurred thereby deducted from the next progress payment of the Contractor. Repeated/fequent infringements upon this policy may be considereed breach of contract.

4. When confilicts arise between the notes and the genereal conditions, plans or specifications, at the determination of the Owner, the most stringent shall apply.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Flag Pole.

1. Base Bid: No flag pole provided.
2. Add-Alternate: Provide flag pole as indicated on Sheet C-105, and as specified in Section 10 75 16 Ground-set Flagpoles. Provide flag pole lighting as indicated on Sheet E0.04.

B. Alternate No. 2: All solid surface countertops.

1. Base Bid: Provide solid surface for countertops with sinks, and plastic laminate for countertops without sinks.
2. Add-Alternate: Provide solid surface for all countertops.

END OF SECTION 01 23 00

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
1. Section 01 23 00 "Alternates" for products selected under an alternate.
2. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
3. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.
3. The following are not considered to be requests for substitutions:
   a. Revisions to the Contract Documents requested by the Owner or Architect.
   b. Specified options of products and construction methods included in the Contract Documents.
   c. The Contractor’s determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit PDF electronic file of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form provided in Project Manual as an attachment to the end of this Section.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) calendar days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) calendar days of receipt of request, or seven (7) calendar days of receipt of additional information or documentation, whichever is later.

a. The Owner, after evaluation of the submitted documentation and advisement by the Architect, will decide whether to consider or reject a request for substitution.
b. Owner may require Contractor to furnish at Contractor’s expense a special performance guarantee or other surety with respect to any proposed substitution.
c. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
d. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen (15) calendar days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Requested substitution provides sustainable design characteristics that specified product provided for pursuing LEED prerequisites and credits.
c. Substitution request is fully documented and properly submitted.
d. Requested substitution will not adversely affect Contractor's construction schedule.
e. Requested substitution has received necessary approvals of authorities having jurisdiction.
f. Requested substitution is compatible with other portions of the Work.
g. Requested substitution has been coordinated with other portions of the Work.
h. Requested substitution provides specified warranty.
i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. The Contractor’s submittal and the Architect’s acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval of any substitution.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

1. Date: Request No:

2, Project Name: **Baltimore County Eastern Family Resource Center 213125.10**

3. Specification Reference:

4, Description of specified product or system:

5. Trade name, model number, and name of proposed substitution:

6. What effect does substitution have on applicable code requirements?

7. Differences between proposed substitution and specified item? *(if required, use attachment for additional space.)*

8. Manufacturer's warranty on proposed and specified items are:

Same □ *Different* □

(Explain on attachment)

9. Reason for requesting substitution:

10. Monetary considerations:

Specified Product $

Proposed Substitution $

11. Will the Undersigned pay for changes *to* the building design, including engineering and detailing

costs, caused by the requested substitution? Yes □ No □

12. Enclosed data consists of:

Catalog □ Drawings □ Samples □ Tests □ Reports □

13. List availability of maintenance service and replacement material

14. State effects of substitution on construction schedule and changes required in other work or product:

15. Any license *fees or royalties:* Yes □ No □

UNDERSIGNED certifies:

- **Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.**
- **Same warranty will be furnished for proposed substitution as for specified product-**
- **Same maintenance service and source of replacement parts as applicable is available.**
- **Proposed Substitution will riot affect or delay Progress Schedule.**
- **Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived by the Contractor.**
- **Proposed substitution does not affect dimensions or functional clearances-**
- **Payment will be made for changes to building design, including architectural or engineering design, detailing, and construction costs caused by proposed substitution.**
- **Coordination, installation, and changes to the Work as necessary for accepted substitution will be complete in all respects.**

Submitted by:

Signature

Firm

Address

Date

Telephone

Approved by Contractor

By:

For use by Owner

Accepted: □ Accepted As Noted: □

Not Accepted: □ Received Too Late: □

Date

Remarks:

REQUEST FOR SUBSTITUTION
END OF FORM

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.
2. Section 01 81 13.13 "Sustainable Design Requirements - LEED for New Construction and Major Renovations" for administrative requirements governing calculation of Project materials cost data required for documentation of Materials and Resources (MR) credits using GBCI's LEED Online resource.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect at earliest possible date, but no later than seven (7) days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Architect.
c. Architect's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

        1) Labor.
        2) Materials.
        3) Equipment.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five (5) percent of the Contract Sum.

    a. Include separate line items under Contractor and principal subcontracts for LEED documentation and other Project closeout requirements in an amount totaling five (5) percent of the Contract Sum and subcontract amount.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

8. Requirements for LEED Documentation:

    a. Each line item in the Schedule of Values shall be broken down into the following categories, containing solely the following:

        1) Labor cost.
        2) Material cost.
        3) Equipment cost.

    b. No General Conditions, insurance, overhead or profit are to be included in the above listed categories in order to accurately calculate certain LEED credits.
    c. General Contractor is responsible for collection and review of both LEED Materials and LEED Wood Submittal Processing Sheets, as well as the LEED Low-Emitting

Materials Subcontractor Submittal Sheet required in subcontractor submittals for both completeness and accuracy.

9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

A. Adhere to Baltimore County's requirements in the General Conditions.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Interpretation (RFIs).
4. Project meetings.

B. Related Requirements:

1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.
4. Section 01 81 13.13 "Sustainable Design Requirements - LEED for New Construction and Major Renovations" for LEED requirements for the Project.
5. Section 01 91 13 "General Commissioning Requirements" for coordinating the Work with the Commissioning Authority.

1.3 DEFINITIONS

A. RFI: Request, initiated either by the Owner or the Contractor, asking for interpretation of an item in the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office,and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is

required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

    a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    e. Indicate required installation sequences.
    f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. BIM File Incorporation: Develop and incorporate coordination drawing files into Building Information Model established for Project.

    a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.

2. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

    a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    b. Digital Data Software Program: Drawings are available in Revit 2014.
    c. Prior to release of the files, Contractor and each subcontractor requesting digital data drawing files shall execute a data licensing agreement in the form of the Architect's "Digital Information Release Agreement" included in Project Manual as an attachment to Section 01 33 00 "Submittal Procedures."

1.7 REQUESTS FOR INTERPRETATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Frivolous RFIs: A frivolous RFI is an RFI for which the answer is simply a reference to the Drawings or Specifications with no additional input required to clarify or answer the question.

C. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature certifying that the request has been researched in the Drawings and Specifications, and is not answered by the Contract Documents.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

D. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

E. Architect's Action: Architect will review each RFI, determine action required, and respond. The Architect will respond to RFI’s within an average of seven (7) business days. It is acknowledged and understood that some RFI’s will take longer to respond to than others dependent on the complexity of the specific issue. RFIs received by Architect after 1:00 p.m. will be considered as received the following business day.

1. The following Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
    h. RFIs deemed by the Architect to be frivolous.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within seven (7) calendar days of receipt of the RFI response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log at each progress meeting. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

G. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven (7) calendar days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three (3) business days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than fifteen (15) calendar days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Commissioning Authority (CxA), Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Phasing.
c. Critical work sequencing and long-lead items.
d. Designation of key personnel and their duties.
e. Lines of communications.
f. Procedures for processing field decisions and Change Orders.
g. Procedures for RFIs.
h. Procedures for testing and inspecting.

i. Procedures for processing Applications for Payment.
j. Distribution of the Contract Documents.
k. Submittal procedures.
l. Sustainable design and LEED requirements.
m. Preparation of record documents.
n. Use of the premises.
o. Work restrictions.
p. Working hours.
q. Owner's occupancy requirements.
r. Responsibility for temporary facilities and controls.
s. Procedures for moisture and mold control.
t. Procedures for disruptions and shutdowns.
u. Construction waste management and recycling.
v. Parking availability.
w. Office, work, and storage areas.
x. Equipment deliveries and priorities.
y. First aid.
z. Security.
aa. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. LEED Coordination Conference: Architect will schedule and conduct a LEED coordination conference before starting construction, at a time convenient to Owner, Architect, and Contractor.

1. Attendees: Authorized representatives of Owner, Commissioning Authority (CxA), Architect, and their consultants; Contractor and its superintendent and LEED coordinator; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect meeting requirements for LEED certification, including the following:

a. LEED Project Checklist.
b. General requirements for LEED-related procurement and documentation, including Contractor’s responsibility for documentation of LEED prerequisites and credits for the Project designated as the Contractor’s responsibility using GBCI’s LEED Online resource.
c. Project closeout requirements and LEED certification procedures.
d. Role of LEED coordinator.
e. Construction waste management.
f. Construction operations and LEED requirements and restrictions.

D. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction and where required by the Specifications in individual Sections.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Owner of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. LEED requirements.
i. Review of mockups.
j. Possible conflicts.
k. Compatibility problems.
l. Time schedules.
m. Weather limitations.
n. Manufacturer's written instructions.
o. Warranty requirements.
p. Compatibility of materials.
q. Acceptability of substrates.
r. Temporary facilities and controls.
s. Space and access limitations.
t. Regulations of authorities having jurisdiction.
u. Testing and inspecting requirements.
v. Installation procedures.
w. Coordination with other work.
x. Required performance results.
y. Protection of adjacent work.
z. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

E. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than ninety (90) days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for completing LEED documentation.
e. Requirements for preparing operations and maintenance data.
f. Requirements for delivery of material samples, attic stock, and spare parts.
g. Requirements for demonstration and training.

h. Preparation of Contractor's punch list.
i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
j. Submittal procedures.
k. Owner's partial occupancy requirements.
l. Installation of Owner's furniture, fixtures, and equipment.
m. Responsibility for removing temporary facilities and controls.

4. Minutes: Record and distribute the meeting minutes to each party present and to parties requiring information.

F. Progress Meetings: Conduct progress meetings at biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Sequence of operations.
2) Resolution of BIM component conflicts.
3) Status of submittals.
4) Status of LEED documentation.
5) Quality and work standards.
6) Status of correction of deficient items.
7) Field observations.
8) Site safety.
9) Status of RFIs.
10) Status of proposal requests.
11) Pending changes.
12) Status of Change Orders.
13) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

G. Commissioning Meetings: Refer to Section 01 91 13 “General Commissioning Requirements.”

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Construction schedule updating reports.
3. Daily construction reports.
4. Site condition reports.
5. Special reports.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting schedules and reports.
2. Section 01 40 00 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. PDF electronic file.
2. Two (2) paper copies.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

C. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

D. Construction Schedule Updating Reports: Submit with Applications for Payment.

E. Daily Construction Reports: Submit at weekly intervals.

F. Site Condition Reports: Submit at time of discovery of differing conditions.

G. Special Reports: Submit at time of unusual event.

H. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than twenty (20) days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than fifteen (15) days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than thirty (30) days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing construction.
b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Partial occupancy before Substantial Completion.
e. Use of premises restrictions.
f. Provisions for future construction.
g. Seasonal variations.

h. Environmental control.

2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c. Purchases.
d. Mockups.
e. Fabrication.
f. Sample testing.
g. Deliveries.
h. Installation.
i. Tests and inspections.
j. Adjusting.
k. Curing.
l. Building flush-out.
m. Startup and placement into final use and operation.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Interpretation.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is seven (7) or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within fourteen (14) days of date established for the Notice to Proceed. Outline significant construction activities for the first ninety (90) days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than thirty (30) days after date established for the Notice to Proceed.

    a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.
    f. Utility interruptions.
    g. Installation.
    h. Work by Owner that may affect or be affected by Contractor's activities.
    i. Testing and commissioning.
    j. Punch list and final completion.
    k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.

17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.4 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one (1) day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Contractor's Construction Schedule Updating: At bi-weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Periodic construction photographs.

B. Related Requirements:
   1. Section 01 33 00 "Submittal Procedures" for submitting photographic documentation.
   2. Section 01 77 00 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
   3. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit unaltered, original, full-size image files within three (3) days of taking photographs.

   1. Digital Camera: Minimum sensor resolution of eight (8) megapixels.
   2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
   3. Identification: Provide the following information with each image description in file metadata tag:

      a. Name of Project.
      b. Date photograph was taken.
      c. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
      d. Unique sequential identifier keyed to accompanying key plan.

1.4 CLOSEOUT SUBMITTALS

A. Submit a CD or DVD disc containing all of the digital photographs taken of the Work of this Project.

B. Use photographs taken of construction IAQ management plan practices (during construction) for submission of documentation to GBCI per the LEED-Online documentation requirements for LEED IEQ Credit 3.1.

1.5 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of eight (8) megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

D. Periodic Construction Photographs: Take no less than fifteen (15) photographs bi-weekly, showing full scope of ongoing work. Maintain a detailed photo log of the construction IAQ management plan practices followed during construction for documentation required for LEED IEQ Credit 3.1: Construction Indoor Air Quality Management Plan - During Construction.

1. Each photograph date stamped.
2. Each photograph identified with an accurate description of the Work depicted.
3. Each photograph identified as to actual location of picture relative to the Drawings.

E. Project Closeout: Provide a record copy of all construction digital photographs on disc.

END OF SECTION 01 32 33

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 01 25 00 “Substitution Procedures” for administrative and procedural procedures for substitutions.
2. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
3. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 01 32 33 “Photographic Documentation” for construction photographs required during the execution of the Work.
5. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
6. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
7. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
8. Divisions 02 through 33 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that the Architect requires to verify performance and quality of project components, but do not require Architect's responsive action. They are also used as verification and certification that the installed work or portion of the work meets the specified requirements. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

D. Submittals: During construction, the Contractor is required by the Contract Documents to submit product data, shop drawings, samples, informational submittals, closeout submittals, and maintenance material submittals to the Architect for review. These submittals are not Contract Documents unless specifically identified as such in the Contract Documents, and are not to be used by the Contractor to modify the Contract. Submittals convey information about systems, equipment, materials, products, and administrative matters. They provide important information to the Architect and, through the Architect, to the Owner. Submittals are also an important part of the quality assurance (QA) for a project.

E. Submittal Review: Submittals are reviewed and approved by the Contractor to ensure Contract Document requirements have been met, to check dimensions, and to coordinate with subcontractors. In order to maintain proper lines of communication, the Architect receives submittals only from the Contractor. Once approved by the Contractor, they are submitted to the Architect for review and processing. The Architect's review is limited to determining whether the submittal is consistent with the design intent indicated in the Contract Documents.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

3. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: When requested by the Contractor or subcontractors, and acceptable to the Architect, electronic copies of digital data files of the Contract Drawings may be provided by Architect for Contractor's use in preparing submittals.

1. The Contract Drawings for this Project were prepared using commercial software on computers.

2. Upon Architect's acceptance of request, Architect will furnish digital data drawing files of requested sheets of the Contract Drawings to the Contractor for use in preparing Shop Drawings.

    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. Digital Drawing Software Program: The Contract Drawings are available in Revit 2014 or AutoCAD 2013.
    c. Prior to release of the files, Contractor and each subcontractor requesting digital data drawing files shall execute a data licensing agreement in the form of the Architect's "Digital Information Release Agreement" form provided in Project Manual as an attachment to the end of this Section and submit the signed agreement to the Architect.
    d. The final determination of which files can be released will be made by the Architect.
    e. The following digital data files may be furnished for each appropriate discipline at the Architect's discretion:

        1) Floor plans.
        2) Reflected ceiling plans.

B. General Submittal Requirements:

1. Clarity of Submittals: Concise and comprehensive. Pertinent data with all extraneous information deleted. Only data applicable to this Project, supplemented as necessary. Materials, finishes, and option selections indicated. Illustrate fabrication and installation attachments. Indicate specific proposed products and work. Editing marks not to be confused with review marks; do not use red ink or font. Cross reference information to Contract Documents. Where the term "or others" appears, indicate on submittal who is to furnish the material or perform operation so marked.
2. Completeness: A logical sequence of related information. Sufficient information correlated with requirements of the Contract Documents. Properly identified items with space provisions for processing. Product data (materials and compliance) prior to or simultaneous with shop drawings and samples. Shop drawings (graphic assembly) prior to or simultaneous with samples or mockups. Samples (colors and finishes) coordinated and submitted together.
3. Titles, Labels, and Tags: Provide identification and blank spaces for processing. Do not title, label, or stamp in a manner to conceal finishes or information.

    a. Product Data: If space does not exist, provide a title page with blank space.
    b. Shop Drawings: Include title block with adjacent blank space of size specified.
    c. Samples: Securely attach labels and tags.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received. Architect will notify Owner and Contractor if action on a submittal is withheld.

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: The Architect will review and return submittals in an average of fifteen (15) calendar days. It is acknowledged and understood that some submittals will take longer to review than others dependent on the complexity of the specific issues involved and the magnitude and quantity of submittals in review at that time. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow sufficient time for review of each resubmittal dependent on the complexity of the specific issues involved and the magnitude and quantity of submittals in review at that time. Time necessary for Architect's and Architect's consultants' review of resubmittals shall be absorbed by the Contractor.

E. Electronic Submittals: Submit required submittals as PDF electronic files unless otherwise indicated. Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number.

a. File name shall use Specification Section number followed by a hyphen and then a sequential number (e.g., 061000-01). Resubmittals shall include the letter "R" after another hyphen (e.g., 061000-01-R).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner and Architect**,** containing the following information:

a. Project name.
b. Date.
c. Name of Architect.
d. Name of Contractor.
e. Name of subcontractor.
f. Name of supplier.
g. Name of manufacturer.
h. Submittal number.

1) Submittal number shall use Specification Section number followed by a hyphen and then a sequential number (e.g., 061000-01). Resubmittals shall include the letter "R" after another hyphen (e.g., 061000-01-R).

i. Drawing number and detail references, as appropriate.

j. Other necessary identification.

k. Remarks.

F. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect or Architect's consultant.
3. Include the following information for processing and recording action taken:

a. Project name.
b. Date.
c. Name of Architect.
d. Name of Contractor.
e. Name of subcontractor.
f. Name of supplier.
g. Name of manufacturer.
h. Submittal number.

1) Submittal number shall use Specification Section number followed by a hyphen and then a sequential number (e.g., 061000-01). Resubmittals shall include the letter "R" after another hyphen (e.g., 061000-01-R).

i. Drawing number and detail references, as appropriate.
j. Location(s) where product is to be installed, as appropriate.
k. Other necessary identification.

4. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Contractor.

a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

1) Project name.
2) Date.
3) Name of Architect.
4) Name of Contractor.
5) Name of subcontractor.
6) Name of supplier.
7) Name of manufacturer.
8) Submittal number.

a) Submittal number shall use Specification Section number followed by a hyphen and then a sequential number (e.g., 061000-01). Resubmittals shall include the letter "R" after another hyphen (e.g., 061000-01-R).

9) Drawing number and detail references, as appropriate.
10) Other necessary identification.
11) Remarks.
12) Signature of transmitter.

G. Options: Identify options requiring selection by Architect.

H. Deviations and Additional Information: Highlight, encircle, or otherwise clearly identify deviations from the Contract documents on submittals.

I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. A maximum of two (2) submittal reviews will be conducted; the initial review plus one (1) re-submittal.

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's consultants, or with “No Exception Taken” or “Exceptions as Noted” from the Architect.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and issue submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files unless otherwise indicated.

a. Architect will return annotated file. Annotate and retain one (1) copy of file as an electronic Project record document file.

2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer’s written recommendations.
b. Manufacturer's catalog cuts.
c. Manufacturer's product specifications.
d. Mill reports.
e. Standard color charts.
f. Statement of compliance with specified referenced standards.
g. Testing by recognized testing agency.
h. Application of testing agency labels and seals.
i. Notation of coordination requirements.

j. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

   a. Wiring diagrams showing factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   e. Standard product operation and maintenance manuals.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

   a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

   a. Dimensions.
   b. Identification of products.
   c. Fabrication and installation drawings.
   d. Rough-in and setting drawings.
   e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
   f. Shopwork manufacturing instructions.
   g. Templates and patterns.
   h. Schedules.
   i. Design calculations.
   j. Compliance with specified standards.
   k. Notation of coordination requirements.
   l. Notation of dimensions established by field measurement.
   m. Relationship and attachment to adjoining construction clearly indicated.
   n. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:

   a. PDF Electronic File: For sheets no larger than 11 by 17 inches when printed without scaling, submit one electronic file in Adobe Acrobat PDF format for each set of Shop Drawings. Each file to include a cover page from the Contractor indicating that the Contractor has reviewed the information being submitted per “Contractor’s Review” Article in Part 3 of this Section. Architect will return a file in Adobe Acrobat PDF format with a comment sheet denoting Architect’s action included at the front. Print out and retain one (1) returned copy as a project record document.

      1) PDF electronic files for Shop Drawing sheets that, when printed, are larger than 11 by 17 inches will not be accepted and will not be reviewed by the Architect or the Architect’s and Owner’s consultants.

b. Paper Copies: For Shop Drawing submittals including sheets larger than 11 by 17 inches when printed without scaling, submit no less than three (3) opaque (bond) copies of each submittal. Architect will return one (1) copy.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of applicable Specification Section.
   e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

   a. Number of Samples: Submit two (2) full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return one (1) full set with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit two (2) sets of Samples. Architect will return one (1) Sample for project record.

      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit two (2) sets of paired units that show approximate limits of variations.

E. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

F. Meeting and Conference Minutes: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."

H. Test and Inspection Reports and Schedule of Required Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."

J. Project Warranties: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on

evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Manufacturer’s Written Instructions: Submit manufacturer-prepared instructions concerning the proper application or installation of a product or system.

Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

Z. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.

1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmission.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file, signed and sealed by the

responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S AND ARCHITECT'S CONSULTANTS' ACTION

A. Action Submittals: Architect or Architect's consultants will review each submittal, make marks to indicate corrections or revisions required, and return it.

1. Architect will attach a review sheet to each submittal reviewed by Architect and will make appropriate notes to indicate action, as follows:

a. "No Exception Taken": Submittals which require no corrections.
b. "Exceptions as Noted": Minor amount of corrections are noted on the submittal; necessary corrections will be assumed as understood by Contractor unless the Architect is notified within seven (7) calendar days.
c. "Incomplete/Resubmit": Submittals returned to the Contractor and not considered as submitted, such as:

1) Violation of submission procedures.
2) Inadequately reviewed by the Contractor.
3) Not containing the Contractor's approval stamp.
4) Inaccurate and substantially in error.
5) Lacking completeness or clarity.

d. "Not Subject to Review": Submittals outside of the scope of the Contract Documents and thus returned to the Contractor and not considered as submitted.
e. "Disapproved/Resubmit": Submittals contrary to requirements of the Contract Documents including submission procedure. Necessary corrections are too extensive for consideration.
f. "Provide File Copy with Requested Corrections Identified": Make corrections noted on the submittals and provide a file copy of the corrected submittal for Project documentation. Necessary corrections will be assumed as understood by Contractor unless the Architect is notified within seven (7) calendar days.

2. Architect's consultants will stamp each submittal reviewed by consultant with an action stamp and will mark stamp appropriately to indicate action. Submittals will be returned to the Contractor through the Architect.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 01 33 00

DIGITAL INFORMATION RELEASE AGREEMENT

Date:	
Project:	Eastern Family Resource Center
HCM Project No:	213125.10

Hord, Coplan Macht, Inc. (HCM) is preparing construction documents on a computer system, which documents are being published for bidding and construction purposes. The undersigned has requested to be provided certain information in digital format. HCM will provide services to develop modified copies of digital files for the subject project with the following understanding and conditions:

1. The undersigned understands that the digital information may change after this issuance in digital format. The digital information has not been finally verified against the hard copy, and thus may contain errors and extraneous data. Data stored on electronic media can deteriorate undetected and may be modified or altered without the knowledge of HCM. The use of the digital information is wholly at the risk of the undersigned.

2. The hard copy of these documents as issued by HCM is to be relied upon for the purposes of bidding and construction, not the digital information. To the extent there is any variation between the hard copy and the digital format thereof, the hard copy is the sole basis for determining all matters relating to the Work.

3. The use of the digital information shall not in any way obviate the undersigned's responsibility for the proper checking and coordination of as built conditions, dimensions, details, member sizes and gauge, and quantities of materials as required to facilitate complete and accurate fabrication and erection.

4. The digital information was generated utilizing commercial software (AutoCad, Revit) under license to HCM, and HCM is under no obligation to provide any software or hardware required to read and manipulate said information. HCM is also under no obligation to provide supplemental files, and linked data (e.g., font files, line types, or external references). The digital files to be provided for this project will be in either .dwg, .dwf or .rvt format as determined by HCM.

5. HCM is under no obligation to correct, modify, or update the digital information or to notify the undersigned of any need to correct, modify, or update the digital information.

6. Unless modified elsewhere, the digital information is the property of the author/ design professional. Hence, HCM neither owns nor controls the release of our consultants digital files (i.e. MEP, structural, civil, etc.).

7. It is at the sole discretion of HCM to determine the architectural files to be released and any cost for the same.

8. The undersigned agrees to indemnify, defend, release, and hold HCM, their consultants, and the owner harmless from any responsibility or obligation as to the accuracy or completeness of the digital information and further waives any claim it may have for expenses, including but not limited to attorney's fees, resulting from the undersigned relying upon or utilizing the digital information.

9. The digital files are provided for the exclusive use of the undersigned personnel ONLY. The information will not be transferred or transmitted by the undersigned for use by others.

10. The above shall constitute the entire agreement between Hord Coplan Macht, Inc, and the undersigned for providing the above service.

11. This agreement does not constitute a waiver of copyright or a transfer of ownership of said information and documents. The said information and documents can be used only for the above referenced Project.

THIS AGREEMENT ACCEPTED BY:

Company:	**Hord Coplan Macht, Inc**	Company:
Name:		Name:
Title:		Title:
Signature:		Signature:

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority (CxA), or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

C. Related Requirements:
1. Divisions 02 through 33 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five (5) previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor’s Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

D. Schedule of Required Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents**,** including tests and inspections indicated to be performed by the Commissioning Authority.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee

payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Maryland and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority (CxA), with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

a. Allow seven (7) days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least twenty-five (24) hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority (CxA), and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Commissioning Authority (CxA), and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Required Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's (CxA's), and Owner's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

TABLE 1704.3
REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION
(REF. STANDARDS: AISC 360, AWS D1.1 & D1.3, APPLICABLE ASTM STANDARDS)

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC
1. Material verification of high-strength bolts, nuts and washers:		
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	–	X
b. Manufacturer's certificate of compliance required.	–	X
2. Inspection of high-strength bolting:		
a. Snug-tight joints.	–	X
b. Pretensioned and slip-critical joints using turn-of-nut with matchmarking, twist-off bolt or direct tension indicator methods of installation.	–	X
c. Pretensioned and slip-critical joints using turn-of-nut without matchmarking or calibrated wrench methods of installation.	X	–
3. Material verification of structural steel and cold-formed steel deck:		
a. For structural steel, identification markings to conform to AISC 360.	–	X
b. For other steel, identification markings to conform to ASTM standards specified in the approved construction documents.	–	X
c. Manufacturer's certified test reports.	–	X
4. Material verification of weld filler materials:		
a. Identification markings to conform to AWS specification in the approved construction documents.	–	X

TABLE 1704.3 - continued
REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION
(REF. STANDARDS: AISC 360, AWS D1.1 & D1.3, APPLICABLE ASTM STANDARDS)

5. Inspection of Welding:		
a. Structural steel and cold-formed steel deck:		
1) Complete and partial joint penetration groove welds.	X	–
2) Multi-pass fillet welds.	X	–
3) Single-pass fillet welds> 5/16"	X	–
4) Plug and slot welds.	X	–
5) Single-pass fillet welds ≤ 5/16"	–	X
6) Floor and roof deck welds.	–	X
b. Reinforcing steel:		
1) Verification of weldability of reinforcing steel other than ASTM A 706.	–	X
2) Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special structural walls of concrete and shear reinforcement.	X	–
3) Shear reinforcement.	X	–
4) Other reinforcing steel.	–	X
6. Inspection of steel frame joint details for compliance:		
a. Details such as bracing and stiffening.	–	X
b. Member locations.	–	X

c. Application of joint details at each connection.	–	X

TABLE 1705.3
REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION
(REF. ACI 318)

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC
1. Inspection of reinforcing steel including placement.	–	X
2. Inspection of reinforcing steel welding in accordance with Table 1704.3, Item 5b.	–	–
3. Inspection of anchors cast in concrete where allowable loads have been increased or where strength design is used.	–	X
4. Inspection of anchors post-installed in hardened concrete members.	–	X
5. Verifying use of required design mix.	–	X
6. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	–
7. Inspection of concrete placement for proper application techniques.	X	–
8. Inspection for maintenance of specified curing temperature and techniques.	–	X
9. Inspect formwork for shape, location and dimensions of the concrete member being formed.	–	X

TABLE 1705.6
REQUIRED VERIFICATION AND INSPECTION OF SOILS

VERIFICATION AND INSPECTION TASK	CONTINUOUS	PERIODICALLY
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	–	X
2. Verify excavations are extended to proper depth and have reached proper material.	–	X
3. Perform classification and testing of compacted fill materials.	–	X
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill.	X	–
5. Prior to placement of compacted fill, observe subgrade and verify that site has been prepared properly.	–	X

LEVEL 1 REQUIRED VERIFICATION AND INSPECTION OF MASONRY CONSTRUCTION (REF. ACI 530)

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC
1. Compliance with required inspection provisions of the construction documents and the approved submittals shall be verified.	–	X
2. Verification of f'm prior to construction.	–	X
3. Verification of slump flow and VSI as delivered to the site for self-consolidating grout.	X	–
4. As masonry construction begins, the following shall be verified to ensure compliance:		
a. Proportions of site-prepared mortar.	–	X
b. Construction of mortar joints.	–	X
c. Location of reinforcement, connectors and anchorages.	–	X
5. During construction the inspection program shall verify:		
a. Size and location of structural elements.	–	X
b. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction.	–	X
b. Specified size, grade and type of reinforcement, anchor bolts and anchorages.	–	X
e. Preparation, construction and protection of masonry during cold weather (temperature below 40°F) or hot weather (temperature above 90°F).	–	X

TABLE 1704.5.1 − continued
LEVEL 1 REQUIRED VERIFICATION AND INSPECTION OF MASONRY CONSTRUCTION
(REF. ACI 530)

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC
6. Prior to grouting, the following shall be verified to ensure compliance:		
a. Grout space is clean.	–	X
b. Placement of reinforcement and connectors and anchorages.	–	X
c. Proportions of site-prepared grout.	–	X
d. Construction of mortar joints.	–	X
7. Grout placement shall be verified to ensure compliance:	X	–
8. Preparation of any required grout specimens, mortar specimens and/or prisms shall be observed.	–	X

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

1. Definitions for construction terminology not otherwise defined in the Contract Documents are defined in the “Construction Dictionary” as published by the “Greater Phoenix, Arizona Chapter #98 of the National Association of Women in Construction,” 5060 N. 19th Ave. #107, Phoenix, Arizona, 85015-3211; ph: 602-841-7900.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied

directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.

32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CEA - Canadian Electricity Association; www.electricity.ca.
51. CEA - Consumer Electronics Association; www.ce.org.
52. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
53. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
54. CGA - Compressed Gas Association; www.cganet.com.
55. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
56. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
57. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
58. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
59. CPA - Composite Panel Association; www.pbmdf.com.
60. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
61. CRRC - Cool Roof Rating Council; www.coolroofs.org.
62. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
63. CSA - Canadian Standards Association; www.csa.ca.
64. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
65. CSI - Construction Specifications Institute (The); www.csinet.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
68. CWC - Composite Wood Council; (See CPA).
69. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
70. DHI - Door and Hardware Institute; www.dhi.org.
71. ECA - Electronic Components Association; (See ECIA).
72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
73. ECIA - Electronic Components Industry Association; www.eciaonline.org.
74. EIA - Electronic Industries Alliance; (See TIA).
75. EIMA - EIFS Industry Members Association; www.eima.com.
76. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
77. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
78. ESTA - Entertainment Services and Technology Association; (See PLASA).
79. EVO - Efficiency Valuation Organization; www.evo-world.org.
80. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
81. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.

82. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
83. FM Approvals - FM Approvals LLC; www.fmglobal.com.
84. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
85. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com.
86. FSA - Fluid Sealing Association; www.fluidsealing.com.
87. FSC - Forest Stewardship Council U.S.; www.fscus.org.
88. GA - Gypsum Association; www.gypsum.org.
89. GANA - Glass Association of North America; www.glasswebsite.com.
90. GBCI - Green Building Certification Institute; www.gbci.org.
91. GS - Green Seal; www.greenseal.org.
92. HI - Hydraulic Institute; www.pumps.org.
93. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
94. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
95. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
96. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
97. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
98. IAS - International Accreditation Service; www.iasonline.org.
99. IAS - International Approval Services; (See CSA).
100. ICBO - International Conference of Building Officials; (See ICC).
101. ICC - International Code Council; www.iccsafe.org.
102. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
103. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
104. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
105. IEC - International Electrotechnical Commission; www.iec.ch.
106. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
107. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
108. IESNA - Illuminating Engineering Society of North America; (See IES).
109. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
110. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
111. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
112. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
113. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
114. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
115. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
116. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
117. ISO - International Organization for Standardization; www.iso.org.
118. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
119. ITU - International Telecommunication Union; www.itu.int/home.
120. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
121. LMA - Laminating Materials Association; (See CPA).
122. LPI - Lightning Protection Institute; www.lightning.org.
123. MBMA - Metal Building Manufacturers Association; www.mbma.com.
124. MCA - Metal Construction Association; www.metalconstruction.org.
125. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
126. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
127. MHIA - Material Handling Industry of America; www.mhia.org.
128. MIA - Marble Institute of America; www.marble-institute.com.
129. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
130. MPI - Master Painters Institute; www.paintinfo.com.

131. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
132. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
133. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
134. NADCA - National Air Duct Cleaners Association; www.nadca.com.
135. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
136. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
137. NBI - New Buildings Institute; www.newbuildings.org.
138. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
139. NCMA - National Concrete Masonry Association; www.ncma.org.
140. NEBB - National Environmental Balancing Bureau; www.nebb.org.
141. NECA - National Electrical Contractors Association; www.necanet.org.
142. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
143. NEMA - National Electrical Manufacturers Association; www.nema.org.
144. NETA - InterNational Electrical Testing Association; www.netaworld.org.
145. NFHS - National Federation of State High School Associations; www.nfhs.org.
146. NFPA - National Fire Protection Association; www.nfpa.org.
147. NFPA - NFPA International; (See NFPA).
148. NFRC - National Fenestration Rating Council; www.nfrc.org.
149. NHLA - National Hardwood Lumber Association; www.nhla.com.
150. NLGA - National Lumber Grades Authority; www.nlga.org.
151. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
152. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
153. NRCA - National Roofing Contractors Association; www.nrca.net.
154. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
155. NSF - NSF International; www.nsf.org.
156. NSPE - National Society of Professional Engineers; www.nspe.org.
157. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
158. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
159. NWFA - National Wood Flooring Association; www.nwfa.org.
160. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
161. PDI - Plumbing & Drainage Institute; www.pdionline.org.
162. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
163. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
164. RFCI - Resilient Floor Covering Institute; www.rfci.com.
165. RIS - Redwood Inspection Service; www.redwoodinspection.com.
166. SAE - SAE International; www.sae.org.
167. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
168. SDI - Steel Deck Institute; www.sdi.org.
169. SDI - Steel Door Institute; www.steeldoor.org.
170. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
171. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
172. SIA - Security Industry Association; www.siaonline.org.
173. SJI - Steel Joist Institute; www.steeljoist.org.
174. SMA - Screen Manufacturers Association; www.smainfo.org.
175. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
176. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
177. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
178. SPIB - Southern Pine Inspection Bureau; www.spib.org.
179. SPRI - Single Ply Roofing Industry; www.spri.org.
180. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
181. SSINA - Specialty Steel Industry of North America; www.ssina.com.

182. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
183. STI - Steel Tank Institute; www.steeltank.com.
184. SWI - Steel Window Institute; www.steelwindows.com.
185. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
186. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
187. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
188. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
189. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
190. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
191. TMS - The Masonry Society; www.masonrysociety.org.
192. TPI - Truss Plate Institute; www.tpinst.org.
193. TPI - Turfgrass Producers International; www.turfgrasssod.org.
194. TRI - Tile Roofing Institute; www.tileroofing.org.
195. UL - Underwriters Laboratories Inc.; www.ul.com.
196. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
197. USAV - USA Volleyball; www.usavolleyball.org.
198. USGBC - U.S. Green Building Council; www.usgbc.org.
199. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
200. WASTEC - Waste Equipment Technology Association; www.wastec.org.
201. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
202. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
203. WDMA - Window & Door Manufacturers Association; www.wdma.com.
204. WI - Woodwork Institute; www.wicnet.org.
205. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
206. WWPA - Western Wood Products Association; www.wwpa.org.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.

12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 32 12 16 "Asphalt Paving" for construction and maintenance of asphalt pavement for temporary roads and paved areas.
3. Section 32 13 13 "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete bases for supporting posts.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.

2. Conference room of sufficient size to accommodate meetings of ten (10) individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean ducts, blowers, and coils as required in Section 01 77 00 "Closeout Procedures".

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one (1) telephone line for each field office.

1. Provide additional telephone lines for the following:

a. Provide a fax machine for the Contractor’s use and a fax machine for the use of the Owner’s Field Representative. Provide a dedicated telephone line for each facsimile machine.
b. Provide one (1) telephone line for Owner’s use.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone for use when away from field office.

J. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:

1. Processor: Intel Pentium D or Intel CoreDuo, 3.0 GHz processing speed.
2. Memory: 4 gigabyte.
3. Disk Storage: 300 gigabyte hard-disk drive and combination DVD-RW/CD-RW drive.
4. Display: 22-inch LCD monitor with 256-Mb dedicated video RAM.
5. Full-size keyboard and mouse.
6. Network Connectivity: 10/100BaseT Ethernet.
7. Operating System: Microsoft Windows 7 Professional.
8. Productivity Software:

    a. Microsoft Office Professional, XP or higher, including Word, Excel, and Outlook.
    b. Adobe Reader 7.0 or higher.
    c. WinZip 7.0 or higher.

9. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
10. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 384 Kbps upload and 1 Mbps download speeds at each computer.
11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
12. Backup: External hard drive, minimum 40 gigabyte, with automated backup software providing daily backups.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 31 20 00 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.

2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: All parking to be restricted to the construction site. No parking on/at the adjacent properties, including the hospital, nursing home, and college.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

G. Construction Waste Management: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

I. Temporary Elevator Use: Use of elevators is not permitted.

J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 CONSTRUCTION AIDS

A. Provide, erect, and maintain construction aids necessary for expeditious and proper completion of the Work.

B. Modifications and alterations to the Project design to accommodate construction aids are not permitted unless authorized by Owner and Architect. Contractor shall reimburse Owner for any structural evaluation, redesign, and supplemental design of the Work by Architect and their consultants, to accommodate construction aids.

C. Repair and pay for damage, including attachment and support to structure, subgrades, or other portions of the Project, as a result of construction aids.

D. Do not use construction aids which could stress, strain, or damage any portion of the Project and existing structures.

E. Contrive to keep temporary work from obstructing Work and access. If, however, conflict with normal access occurs, provide temporary bypass routing until such temporary work is completed.

F. Remove all temporary work from premises after it is no longer needed and before completion of Contract and repair area to original condition.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01 10 00 "Summary."

C. Temporary Erosion and Sedimentation Control: Comply with requirements of plans approved by Baltimore County Soil Conservation District, and requirements specified in Section 31 10 00 "Site Clearing."

D. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to plans approved by Baltimore County Soil Conservation District.

1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
2. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
3. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
4. Over the course of site work activities, document implementation of the erosion and sedimentation control plan through date-stamped photos, inspection logs or reports, descriptions of corrective action in response to problems, etc. Input documentation requirements as required by GBCI using the LEED-Online resource for LEED SS Prerequisite 1: Construction Activity Pollution Prevention.

E. Stormwater Control: Comply with requirements of plans approved by Baltimore County Department of Environmental Protection & Sustainability. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

G. Site Enclosure Fence: Before construction operations begin, coordinate with the sediment control inspector to furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations, with approval of the sediment control inspector.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for forty-eight (48) hours are considered defective.
b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for forty-eight (48) hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
c. Remove materials that cannot be completely restored to their manufactured moisture level within forty-eight (48) hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.

B. Related Sections include the following:

1. Division 31 Section "Site Clearing" for removal limits of trees, shrubs, and other plantings affected by new construction.
2. Division 31 Section "Earthwork" for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials.
3. Division 32 Section "Plants" for tree and shrub planting, tree support systems, and soil materials.

1.3 DEFINITIONS

A. Tree Protection Zone: Area surrounding individual trees or groups of trees to remain during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated. Additional tree protection zones are those areas enclosed by tree protection fence, installed in the location and manner shown on the plans.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Tree Pruning Schedule: Written schedule from arborist detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

C. Qualification Data: For qualified arborist and tree service firm.

D. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work. Additional recommendations are shown on the forest conservation plan.

1.5 QUALITY ASSURANCE

A. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of tree protection and trimming.

B. Arborist Qualifications: An arborist certified by ISA and licensed in the jurisdiction where Project is located.

C. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."

D. Preinstallation Conference: Conduct conference at Project site.

1. Before tree protection and trimming operations begin, meet with representatives of authorities having jurisdiction, Owner, Landscape Architect, consultants, and other concerned entities to review tree protection and trimming procedures and responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.

B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other nonsoil materials.

1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.

C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

D. Chain-Link Protection Zone Fencing: Metallic-coated steel chain-link fence fabric of 0.120-inch-diameter wire; a minimum of 48 inches high; with 1.9-inch-diameter line posts; 2-3/8-inch-diameter terminal and corner posts; 1-5/8-inch-diameter top rail; and 0.177-inch-diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

E. Organic Mulch: Ground or shredded hardwood bark, free of deleterious materials.

PART 3 - EXECUTION

3.1 PREPARATION

A. Temporary Fencing: Install temporary fencing around tree protection zones to protect remaining trees and vegetation from construction damage. Keep temporary fencing in place for the entire duration of construction. Maintain temporary fence and remove when construction is complete.

1. Install tree protection fence as indicated on the plans.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Mulch areas inside tree protection zones and other areas indicated.

1. Apply 3-inch average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

D. Do not store construction materials, debris, or excavated material inside tree protection zones. Do not permit vehicles or foot traffic within tree protection zones; prevent soil compaction over root systems within tree protection zones.

E. Maintain tree protection zones free of weeds and trash.

F. Do not allow fires within tree protection zones.

3.2 EXCAVATION

A. Install shoring or other protective support systems to minimize sloping or benching of excavations.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.

1. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction.
2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

D. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp, clean pruning instruments; do not pull, tear, break or chop.

3.3 REGRADING

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond tree protection zones. Maintain existing grades within tree protection zones.

1. Where it is not possible to keep all grading outside tree protection zones prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller

roots that interfere with installation of utilities. Cut roots with sharp, clean pruning instruments; do not pull, tear, break or chop. Cover exposed roots with 2 inches of topsoil and 3” of mulch.

B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.4 TREE PRUNING

A. Prune trees to remain that are affected by temporary and permanent construction as recommended by arborist.

B. Provide subsequent maintenance during Contract period as recommended by arborist and as shown on Forest Conservation Plan.

C. Pruning Standards: Prune trees according to ANSI A300 (Part 1)**.**

D. Cut branches with sharp, clean pruning instruments; do not break or chop.

E. Chip removed tree branches and dispose of off-site.

3.5 FIELD QUALITY CONTROL

A. Arborist: Engage a qualified arborist.

3.6 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.

B. Remove and replace trees indicated to remain that die or are damaged during construction operations to such an extent that arborist determines they are incapable of recovering to normal growth patterns.

1. Provide new trees on an inch-per-caliper-inch basis to those being replaced; plant and maintain new trees as specified in Division 2 Section "Exterior Plants."

2. Trees shown on the Tree Conservation Plan as to be protected are regulated by the Forest Conservation Act. Additional tree replacement and/or fines may be required by the Forest Conservation Inspector.

C. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.7 DISPOSAL OF WASTE MATERIALS

A. Burning is not permitted.

B. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 01 56 39

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
1. Section 01 23 00 "Alternates" for products selected under an alternate.
2. Section 01 25 00 "Substitution Procedures" for procedures for submittal of requests for substitutions for specified products.
3. Section 01 42 00 "References" for applicable industry standards for products specified.
4. Section 01 73 00 “Execution” for installation of products and progress cleaning.
5. Section 01 81 13.13 “Sustainable Design Requirements - LEED for New Construction and Major Renovations” for requirements for materials and resources for Projects pursuing LEED certification.
6. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics

for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within fifteen (15) calendar days of receipt of request, or seven (7) calendar days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Section 01 33 00 "Submittal Procedures."
b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.

2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

6. Or Equal: Where products are specified by name and accompanied by the term “or equal” or “or approved equal” or “or approved,” comply with provisions in Part 2 “Comparable Products” Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
    b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification:

1. Standard Range: Where Specifications include the phrase "as selected by Architect from manufacturer's standard range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes only standard items; custom, designer, or premium items will not be included.
2. Full Range: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes standard as well as custom, designer, and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Comparable products will only be considered in instances where Specification Sections explicitly state that comparable products are allowed. Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, compliance with specified sustainable design requirements specified for the LEED for New Construction and Major Renovations rating system, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.

B. Related Requirements:

1. Section 01 10 00 "Summary" for limits on use of Project site.
2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
3. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, correction/repair of the Work, and final cleaning.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

D. Certified Surveys: Submit two (2) copies signed by land surveyor.

E. Final Property Survey: Submit two (2) copies showing the Work performed and record survey data.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for interpretation to Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

D. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 84 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Noise Control: Perform construction operations to minimize noise. Perform noise-causing work in less sensitive hours of the day or week as directed by the Owner. Limit noise as may be required by the authorities having jurisdiction.

H. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

I. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

J. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

K. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 91 13 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the diversion of nonhazardous demolition and construction debris from disposal in landfills and incineration facilities.

B. Related Requirements:

1. Section 01 81 13.13 “Sustainable Design Requirements – LEED for New Construction and Major Renovations” for general LEED requirements.
2. Section 04 20 00 "Unit Masonry" for disposal requirements for masonry waste.
3. Section 31 10 00 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, paint, or the like.

B. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

C. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

D. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

E. Diversion: Avoidance of demolition and construction waste sent to landfill or incineration. Diversion does not include using materials for landfill, alternate daily cover on landfills, or materials used as fuel in waste-to-energy processes.

F. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitability, corrosiveness, toxicity, or reactivity.

G. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

H. Recycling: The process of sorting, cleansing, treating, and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

J. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

K. Toxic: Poisonous to humans either immediately or after a long period of exposure.

L. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

M. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve minimum end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including, but not limited to, the following:

1. Demolition Waste:

   a. Asphalt paving.
   b. Concrete.
   c. Concrete reinforcing steel.
   d. Lighting fixtures.
   e. Lamps.
   f. Ballasts.
   g. Electrical devices.

2. Construction Waste:

   a. Masonry and CMU.
   b. Concrete.
   c. Stone and gravel.
   d. Asphalt.
   e. Lumber.
   f. Wood sheet materials.
   g. Wood trim.
   h. Metals.
   i. Glass.
   j. Roofing.
   k. Insulation.
   l. Carpet and pad.
   m. Gypsum board.
   n. Piping.
   o. Electrical conduit.
   p. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

      1) Paper.
      2) Cardboard.

3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within seven (7) calendar days of date established for the Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Track and keep a summary log of all construction waste generated by type, the quantities of each type that were diverted and landfilled, and the total percentage of waste diverted from landfill disposal. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan. Plan shall, at a minimum, identify the diversion goals, relevant construction debris and materials to be diverted, implementation protocols, and parties responsible for implementing the plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.

3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three (3) working days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

E. Hazardous Wastes: Hazardous wastes shall be separated, stored, and disposed of according to local regulations and should not be included in Construction Waste Management Plan’s calculations of waste.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:

1. Roll-Off Express, 2900 Dede Road, Finksburg, MD 21048; ph. (410) 526-3535.

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

D. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

E. Procedures: Collect all demolition and construction waste in a single container at the Project site. Separate recyclable waste from other waste materials, trash, and debris later at the recycling facility according to approved construction waste management plan.

3.3 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch size.
2. Crush concrete and screen to comply with requirements in Section 31 20 00 "Earth Moving" for use as satisfactory soil for fill or subbase.

3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

3.5 LEED DOCUMENTATION

A. Provide the required documentation to GBCI using the LEED Online resource for the following LEED prerequisites and credits:

1. MR Credit 3: Construction Waste Management:

a. Records of Donations: Obtain receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

b. Records of Sales: Obtain receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
c. Recycling and Processing Facility Records: Obtain records of receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
d. Landfill and Incinerator Disposal Records: Obtain records of receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them.
e. Waste Reduction Calculations: Before request for Substantial Completion, calculate end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
f. Documentation: Input required documentation data into GBCI's LEED Online template for Credit MR 2, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

END OF SECTION 01 74 19

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Correction/repair of the Work.

B. Related Requirements:

1. Section 01 32 33 "Photographic Documentation" for submitting a record disc of construction photographs to the Owner prior to final completion of the Project.
2. Section 01 73 00 "Execution" for progress cleaning of Project site.
3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 01 79 00 "Demonstration and Training" for requirements for instructing Owner's personnel.
6. Section 01 81 13.13 "Sustainable Design Requirements – LEED for New Construction and Major Renovations" for procedures regarding the documentation of LEED prerequisites and credits that are the responsibility of the Contractor by using GBCI's LEED Online resource.
7. Section 01 91 13 "General Commissioning Requirements" and Section 23 08 00 "Commissioning of HVAC" for commissioning process activities.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items (Punch List): Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items (Punch List): Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Requesting Inspection for Determining Date of Substantial Completion: Complete the following a minimum of ten (10) calendar days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include use and occupancy (U&O) permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Requesting Inspection for Determining Date of Substantial Completion: Complete the following a minimum of ten (10) calendar days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.

10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) calendar days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 01 29 00 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request to the Owner and Architect for final inspection to determine final acceptance a minimum of ten (10) calendar days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Owner will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items (Punch List) in the following format:

    a. PDF electronic file. Architect will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within fifteen (15) calendar days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Remove snow and ice to provide safe access to building.
    f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    h. Sweep concrete floors broom clean in unoccupied spaces.
    i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    k. Remove labels that are not permanent.
    l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
    q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

3.2 CORRECTION/REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Repair components that do not operate properly. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be

repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

C. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Section 01 91 13 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.
3. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Initial Manual Submittal: Submit two (2) draft copies of each manual at least fifteen (15) calendar days before requesting inspection for determining date of Substantial Completion. Architect and Commissioning Authority (CxA) will comment on whether general scope and content of manual are acceptable.

B. Final Manual Submittal: Submit three (3) copies of each manual in final form at least fifteen (15) calendar days before final inspection.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Name and contact information for Commissioning Authority (CxA).

8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
9. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one (1) volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one (1) system into a single binder.

E. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

   a. If two (2) or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 01 78 39 "Project Record Documents."

G. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.

B. Related Requirements:

1. Section 01 73 00 "Execution" for final property survey.
2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Divisions 02 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one (1) set of marked-up record prints with separate rolls for each discipline.

B. Record Specifications: Submit one (1) paper copy of Project's Specifications, including addenda and contract modifications.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: DWG, Version 2010, Microsoft Windows operating system.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

a. See Section 01 33 00 "Submittal Procedures" for requirements related to use of Architect's digital data files.
b. Architect will provide data file layer information. Record markups in separate layers.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly

prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as paper copy.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Video recordings of demonstration and training sessions.

B. Related Requirements:

1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for systems, equipment, and products specified in those Sections.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit a PDF electronic file of outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Training Manual: At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals.

B. Demonstration and Training Video Recordings: Submit two (2) copies on DVD within seven (7) calendar days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Architect.
d. Name of Construction Manager (CMa).
e. Name of Contractor.
f. Date of video recording.

2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Motorized doors, including overhead coiling doors and automatic entrance doors.
2. Equipment, including stage equipment, projection screens, food-service equipment, and appliances.
3. Fire-protection systems, including fire alarm, fire pumps, and fire-extinguishing systems.
4. Intrusion detection systems.
5. Conveying systems, including elevators.
6. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping, and water distribution piping.

7. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
8. HVAC systems, including air-handling equipment, air distribution systems, and terminal equipment and devices.
9. HVAC instrumentation and controls.
10. Electrical service and distribution, including transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
11. Packaged engine generators, including transfer switches.
12. Lighting equipment and controls.
13. Communication systems, including intercommunication, surveillance, clocks and programming, voice and data, and television equipment.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.

g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least fourteen (14) calendar days' advance notice. Notify Architect and Commissioning Authority (CxA) of dates, times, and locations of instruction of Owner's personnel.

B. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

C. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.

1. Electronic Media: Read-only format CD or DVD acceptable to Owner, with commercial-grade graphic label.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:

    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

END OF SECTION 01 79 00

SECTION 01 81 13.13

SUSTAINABLE DESIGN REQUIREMENTS
LEED FOR NEW CONSTRUCTION AND MAJOR RENOVATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to pursue LEED Silver certification based on USGBC's "LEED 2009 for New Construction and Major Renovations Rating System."

1. Other LEED prerequisites and credits needed to pursue LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to pursue LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
2. Additional LEED prerequisites and credits needed to pursue the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
3. A copy of the LEED Project checklist is provided in the Project Manual as an attachment to the end of this Section. It is provided for information only.
4. Specific requirements for LEED are included in greater detail in other Sections.

B. Contractor’s Scope of Work for LEED Certification:

1. Participate in the design process as part of the Integrated Design Team.
2. Prepare and complete LEED templates and upload supporting documentation to LEED Online per the requirements for the following LEED prerequisites and credits. Documentation includes, but is not limited to, photos, narratives, material receipts, calculations, spreadsheets, product data, and cut sheets.

a. Sustainable Sites:

1) SS Prerequisite 1: Construction Activity Pollution Prevention.

b. Materials and Resources:

1) MR Credit 2: Construction Waste Management.
2) MR Credit 4: Recycled Content.
3) MR Credit 5: Regional Materials.
4) MR Credit 7: Certified Wood.

c. Indoor Environmental Quality:

1) IEQ Credit 3.1: Construction Indoor Air Quality Management Plan – During Construction.

2) IEQ Credit 3.2: Construction Indoor Air Quality Management Plan – Before Occupancy.
3) IEQ Credit 4.1: Low-Emitting Materials – Adhesives and Sealants.
4) IEQ Credit 4.2: Low-Emitting Materials – Paints and Coatings.
5) IEQ Credit 4.3: Low-Emitting Materials – Flooring Systems.
6) IEQ Credit 4.4: Low-Emitting Materials – Composite Wood and Agrifiber Products.

1.3 DEFINITIONS

A. Agrifiber Products: Products made from agricultural fiber.

B. Agrifiber Board: Composite panel product derived from recovered agricultural waste fiber from sources such as cereal straw, sugarcane bagasse, sunflower husk, walnut shells, coconut husks, and agricultural prunings. The raw fibers are processed and mixed with resins to produce panel products with characteristics similar to those derived from wood fiber.

C. Chain-of-Custody (COC): A tracking procedure for a product from the point of harvest or extraction to its end use, including all successive stages of processing, transformation, manufacturing, and distribution.

D. Chain-of-Custody Certification: Certification awarded to companies that produce, sell, promote, or trade forest products after audits verify proper accounting of material flows and proper use of the Forest Stewardship Council (FSC) name and logo. The COC certificate number is listed on invoices for nonlabeled products to document that an entity has followed FSC guidelines for product accounting.

E. Composite Wood Products: Products that consist of wood or plant particles or fibers bonded by a synthetic resin or binder. Examples include plywood, particleboard, oriented-strand board (OSB), medium density fiberboard (MDF), and composite door cores. Composite wood components used in assemblies installed inside the building's weatherproofing system are included (e.g., door cores, panel substrates, plywood sections of I-beams).

F. LEED: "Leadership in Energy & Environmental Design." Refer to USGBC's website at www.usgbc.org for further information.

G. LEED Coordinator: A LEED Accredited Professional (AP) who is a principal participant of the Project team. Accreditation certifies that the individual has the knowledge and skills necessary to participate in the LEED application and certification process, holds a firm understanding of green building practices and principles, and is familiar with LEED requirements, resources, and processes. The LEED Coordinator aids the Project Team in understanding the elements of the rating system, the importance of considering interactions among the prerequisites and credits, and the LEED application process. The LEED Coordinator has registered the Project in LEED Online but is not responsible for the input of all of the documentation required by LEED Online for prerequisites and creditsfor the Project; responsibilities of the members of the Project Team for documenting certain prerequisites and credits are identified in the Contract Documents. The entity acting as the LEED Coordinator for this Project is identified in Section 01 10 00 "Summary."

H. LEED Online: The primary online (web-based) resource for managing the LEED documentation process. Through LEED Online, project teams can manage project details, complete documentation requirements for LEED prerequisites and credits, upload supporting files, submit applications for review, receive reviewer feedback, and ultimately earn LEED certification. LEED Online provides a common space where members of a project team can work together to

document compliance with the LEED rating system. All projects must be certified using LEED Online. For more information on the LEED certification process including LEED Online, Credit Interpretation Requests and Rulings, Appeals, and Fees, refer to the LEED Reference Guide for Green Buildings Design and Construction, 2009 Edition and visit www.usgbc.org or www.gbci.org.

I. Recycled Content: The proportion, by mass, of pre-consumer or post-consumer recycled material in a product (ISO 14021).

1. Post-Consumer Recycled Content: The percentage of material in a product that was consumer waste. The recycled material was generated by household, commercial, industrial, or institutional end-users and can no longer be used for its intended purpose. It includes returns of materials from the distribution chain (ISO 14021). Examples include construction and demolition debris, materials collected through recycling programs, discarded products (e.g., furniture, cabinetry, decking), and landscaping waste (e.g., leaves, grass clippings, tree trimmings).
2. Pre-Consumer Recycled Content: The percentage of material in a product that is recycled from manufacturing waste. Examples include planar shavings, sawdust, bagasse, walnut shells, culls, trimmed materials, overissue publications, and obsolete inventories. Excluded are rework, regrind, or scrap materials capable of being reclaimed within the same process that generated them (ISO 14021).

J. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Prepare and complete all LEED Online documentation requirements for the LEED prerequisites and credits identified as the Contractor’s responsibility in this Section, including input of data in the templates for LEED prerequisites and credits, and uploading required backup documentation.

1. For Materials and Resources (MR) credits and Indoor Environmental Quality (IEQ) credits, begin documentation of products in LEED templates upon approval of product submittals by the Architect.
2. The LEED Coordinator will review documentation that has been input into LEED Online prerequisite and credit templates for the Project that are identified as the responsibility of the Contractor as specified in this Section and elsewhere in the Contract Documents. The LEED Coordinator will advise the Contractor of deficiencies that need to be addressed by the Contractor.
3. Notify the Project LEED Coordinator and Architect upon completion of filling out LEED Online templates and other required documentation for each prerequisite and credit.

B. Respond to questions and requests from the LEED Coordinator or Architect and USGBC/GBCI regarding LEED prerequisites and credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until final determination has been made on the Project’s LEED certification application.

C. At regularly scheduled progress meetings, as specified in Section 01 31 00 “Project Management and Coordination,” report on the Contractor’s status of LEED documentation for the prerequisites and credits specified.

D. Exemplary Performance: LEED Innovation and Design credits may be achieved for the LEED credits listed below. The LEED Coordinator will identify for Owner and Contractor which LEED Credits may qualify for Exemplary Performance by reviewing progress in these credits during the construction of the Project.

1. MR Credit 2: Construction Waste Management.
2. MR Credit 4: Recycled Content.
3. MR Credit 5: Regional Materials.
4. MR Credit 7: Certified Wood.

1.5 INFORMATIONAL SUBMITTALS

A. Project Materials Cost Data: Determine the cost of each sustainable material used on the Project that contributes to MR Credit 4: Recycled Content, MR Credit 5: Regional Materials, and MR Credit 7: Certified Wood.

1. As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation. Use LEED Online Table L-3 “Sustainable Materials” or other spreadsheet acceptable to the LEED Coordinator to document sustainable materials costs, manufacturers’/vendors’ names, and percentages of sustainable materials to total materials.

a. Maintain a list of materials and their corresponding costs, excluding labor and equipment for materials in CSI MasterFormat 2012 Edition Divisions 03-10, 31 (Section 31 60 00 “Foundations”), and 32 (Sections 32 10 00 “Paving,” 32 30 00 “Site Improvements,” and 32 90 00 “Planting”) only; including Division 12 is optional.
b. Collect backup documentation such as product data sheets, cut sheets, manufacturers’ letters, etc., as required in order to document the listed products’ sustainable attributes.
c. The Project Materials Cost Data must be used consistently for all Materials and Resources credits being pursued.

B. LEED Action Plans: Provide preliminary submittals within thirty (30) calendar days of date established for the Notice of Award indicating how the following requirements will be met:

1. MR Credit 2: Construction Waste Management: Waste management plan complying with Section 01 74 19 "Construction Waste Management and Disposal."
2. IEQ Credit 3.1: Construction Indoor Air Quality Management Plan - During Construction and IEQ Credit 3.2: Construction Indoor Air Quality Management Plan - Before Occupancy: Construction indoor-air-quality management plan for use during construction, and before occupancy.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Provide products and procedures necessary to pursue LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to pursue LEED credits indicated.

2.2 RECYCLED CONTENT OF MATERIALS

A. MR Credit 4: Recycled Content: Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of twenty (20) percent, based on cost, of the total value of the materials in the Project.

1. The recycled content value of a material assembly is determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
2. Mechanical, electrical, and plumbing components, and specialty items such as elevators, cannot be included in this calculation. Include only materials permanently installed in the Project. Furniture may be included if it is included consistently in MR Credit 3: Materials Reuse through MR Credit 7: Certified Wood.

2.3 REGIONAL MATERIALS

A. MR Credit 5: Regional Materials: Use building materials or products that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of the Project site for a minimum of twenty (20) percent, based on cost, of the total materials value.

1. If only a fraction of a product or material is extracted, harvested, or recovered and manufactured locally, then only a percentage (by weight) must contribute to the regional value.
2. Mechanical, electrical, and plumbing components, and specialty items such as elevators and equipment, must not be included in this calculation. Include only materials permanently installed in the Project. Furniture may be included if it is included consistently in MR Credit 3: Materials Reuse through MR Credit 7: Certified Wood.

2.4 CERTIFIED WOOD

A. MR Credit 7: Certified Wood: Use a minimum of fifty (50) percent (based on cost) of wood-based materials and products that are certified in accordance with the Forest Stewardship Council's principles and criteria, for wood building components. These components include at a minimum, structural framing and general dimensional framing, flooring, sub-flooring, wood doors, and finishes.

1. The cost of all new wood products, both FSC certified and not, must be tallied.
    a. Wood products that are not FSC certified and those that are identified on invoices as FSC Pure and FSC Mixed Credit should be valued at 100 percent of the product cost.
    b. Wood products identified as FSC Mixed (NN) Percent should be valued at the indicated percentage of their cost. For example, a product identified as FSC Mixed 75 percent should be valued at 75 percent of the cost.
2. Wood products identified as FSC Recycled or FSC Recycled Credit do not count toward MR Credit 7: Certified Wood. They qualify instead as recycled-content products that may contribute to MR Credit 4: Recycled Content.
3. The Certified Wood Material Percentage for the Project is equal to the FSC-Certified Wood Material Value ($) divided by the Total New Wood Material Value ($) and multiplied by 100.

4. FSC wood products purchased for temporary use on the Project may be included in the credit calculation at the Project Team's discretion. If any such materials are included, all such materials must be included in the calculation.

    a. Examples of products used for temporary assemblies include formwork, bracing, scaffolding, sidewalk protection, and guard rails.
    b. If such materials are purchased for multiple projects, the Project team may include these materials on one, and only one, project at its discretion.

5. Mechanical, electrical, and plumbing components, and specialty items such as elevators and equipment, must not be included in this calculation. Include only materials permanently installed in the Project. Furniture may be included if it is included consistently in MR Credit 3: Materials Reuse through MR Credit 7: Certified Wood.
6. Chain-of-Custody Requirements: Collect all vendor invoices for permanently installed wood products, FSC certified or not, purchased by the Project Contractor and subcontractors. Vendors are defined as those companies that sell products to the Project Contractor or subcontractors.

    a. Each vendor invoice must conform to the following requirements (except as noted below):

        1) Each wood product must be identified on a line-item basis.
        2) FSC products must be identified as such on a line-item basis.
        3) The dollar value of each line item must be shown.
        4) The vendor's COC certificate must be shown on any invoice that includes FSC products.

    b. Each wood product's vendor that invoices FSC certified products must be COC certified by an FSC-accredited certifier.
    c. Exceptions: In some rare instances, it may not be practical for a vendor to invoice wood products on a line-item basis because the invoice would be dozens of pages long. In such cases, the invoice should indicate the aggregate value of wood products sold by the vendor. If the wood products are FSC certified, comply with the following requirements:

        1) The vendor's COC number must be shown on the invoice.
        2) The invoice must be supplemented by a letter from the vendor stating that the products invoiced are FSC-certified.
        3) The invoice or the letter must state whether the products are FSC Pure, FSC Mixed Credit, or FSC Mixed (NN) Percent.

2.5 LOW-EMITTING MATERIALS

A. IEQ Credit 4.1: Low-Emitting Materials - Adhesives and Sealants: All adhesives and sealants used on the interior of the building (i.e., inside the weatherproofing system and applied on-site) must comply with the following requirements as applicable to the Project scope:

1. Adhesives, Sealants and Sealant Primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168. Volatile organic compound (VOC) limits listed in the table below correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005.

Architectural Applications	VOC Limit	Specialty Applications	VOC Limit

	(g/L less water)		(g/L less water)
Indoor carpet adhesives	50	PVC welding	510
Carpet pad adhesives	50	CPVC welding	490
Wood flooring adhesives	100	ABS welding	325
Rubber floor adhesives	60	Plastic cement welding	250
Subfloor adhesives	50	Adhesive primer for plastic	550
Ceramic tile adhesives	65	Contact adhesive	80
VCT and asphalt adhesives	50	Special purpose contact adhesive	250
Drywall and panel adhesives	50	Structural wood member adhesive	140
Cove base adhesives	50	Sheet applied rubber lining operations	850
Multipurpose construction adhesives	70	Top and trim adhesive	250
Structural glazing adhesives	100		
Substrate Specific Applications	VOC Limit (g/L less water)	Sealants	VOC Limit (g/L less water)
Metal to metal	30	Architectural	250
Plastic foams	50	Nonmembrane roof	300
Porous material (except wood)	50	Roadway	250
Wood	30	Single-ply roof membrane	450
Fiberglass	80	Other	420
Sealant Primers	VOC Limit (g/L less water)		
Architectural, nonporous	250		
Architectural, porous	775		
Other	750		

2. Aerosol Adhesives must comply with Green Seal Standard for Commercial Adhesives GS-36 requirements in effect on October 19, 2000.

Aerosol Adhesives	VOC Limit
General purpose mist spray	65 percent VOCs by weight
General purpose web spray	55 percent VOCs by weight
Special purpose aerosol adhesives (all types)	70 percent VOCs by weight

a. This table excludes adhesives and sealants integral to the waterproofing system or that are not building related.

B. IEQ Credit 4.2: Low-Emitting Materials - Paints and Coatings:

1. Paints and coatings used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with the following criteria as applicable to the Project scope:

a. Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.

1) The VOC concentrations of the product shall not exceed those listed below as determined by U. S. Environmental Protection Agency (EPA) Reference Test Method 24 (Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coatings), Code of Federal Regulations Title 40, Part 60, Appendix A. The calculation of VOC shall exclude water and tinting color added at the point of sale.

a) Flat Paints and Coatings: VOC not more than 50 g/L of product minus water.
b) Nonflat Paints and Coatings: VOC not more than 100 g/L of product minus water.
c) Primer or Undercoat: VOC not more than 100 g/L of product minus water.
d) Floor Paint: VOC not more than 100 g/L of product minus water.

b. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L established in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.

1) The VOC concentrations of the products shall not exceed those listed below as determined by U. S. Environmental Protection Agency (EPA) Reference Test Method 24 (Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coatings), Code of Federal Regulations Title 40, Part 60, Appendix A. The calculation of VOC shall exclude water and tinting color added at the point of sale.

a) Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L of product minus water.

c. Clear wood finishes, floor coatings, stains, primers, sealers, and shellacs applied to interior elements must not exceed the VOC content limits established for those coating types in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2012.

1) Bond Breakers: 350 g/l less water and less exempt compounds.
2) Clear Wood Finishes: 275 g/l less water and less exempt compounds.

a) Varnish: 275 g/l less water and less exempt compounds.
b) Sanding Sealers: 275 g/l less water and less exempt compounds.
c) Lacquer: 275 g/l less water and less exempt compounds.

3) Concrete-Curing Compounds: 100 g/l less water and less exempt compounds.
4) Concrete-Curing Compounds for Roadways and Bridges: 350 g/l less water and less exempt compounds.

5) Concrete Surface Retarder: 50g/l less water and less exempt compounds.
6) Driveway Sealer: 50g/l less water and less exempt compounds.
7) Dry-Fog Coatings: 50g/l less water and less exempt compounds.
8) Faux Finishing Coatings:

    a) Clear Topcoat: 100g/l less water and less exempt compounds.
    b) Decorative Coatings: 350 g/l less water and less exempt compounds.
    c) Glazes: 350 g/l less water and less exempt compounds.
    d) Japan: 350 g/l less water and less exempt compounds.
    e) Trowel Applied Coatings: 50g/l less water and less exempt compounds.

9) Fire-Proofing Coatings: 150g/l less water and less exempt compounds.
10) Flats: 50 g/l less water and less exempt compounds.
11) Floor Coatings: 50 g/l less water and less exempt compounds.
12) Form Release Compound: 100g/l less water and less exempt compounds.
13) Graphic Arts (Sign) Coatings: 150g/l less water and less exempt compounds.
14) Industrial Maintenance (IM) Coatings: 100 g/l less water and less exempt compounds.

    a) High Temperature IM Coatings: 420 g/l less water and less exempt compounds.
    b) Non-Sacrificial Anti-Graffiti Coatings: 100 g/l less water and less exempt compounds.
    c) Zinc-Rich IM Primers: 100 g/l less water and less exempt compounds.

15) Magnesite Cement Coatings: 450 g/l less water and less exempt compounds.
16) Mastic Coatings: 100g/l less water and less exempt compounds.
17) Metallic Pigmented Coatings: 150g/l less water and less exempt compounds.
18) Multi-Color Coatings: 250 g/l less water and less exempt compounds.
19) Nonflat Coatings: 50 g/l less water and less exempt compounds.
20) Pre-Treatment Wash Primers: 420 g/l less water and less exempt compounds.
21) Primers, Sealers, and Undercoaters: 100 g/l less water and less exempt compounds.
22) Reactive Penetrating Sealers: 350 g/l less water and less exempt compounds.
23) Recycled Coatings: 250 g/l less water and less exempt compounds.
24) Roof Coatings: 50 g/l less water and less exempt compounds.

    a) Roof Coatings, Aluminum: 100 g/l less water and less exempt compounds.

25) Roof Primers, Bituminous: 350 g/l less water and less exempt compounds.
26) Rust Preventive Coatings: 100 g/l less water and less exempt compounds.
27) Stone Consolidant: 450 g/l less water and less exempt compounds.
28) Sacrificial Anti-Graffiti Coatings: 50g/l less water and less exempt compounds.
29) Shellac:

    a) Clear: 730 g/l less water and less exempt compounds.
    b) Pigmented: 550 g/l less water and less exempt compounds.

30) Specialty Primers: 100 g/l less water and less exempt compounds.
31) Stains: 100 g/l less water and less exempt compounds.

a) Stains, Interior: 250 g/l less water and less exempt compounds.

32) Swimming Pool Coatings:

a) Repair: 340 g/l less water and less exempt compounds.
b) Other: 340 g/l less water and less exempt compounds.

33) Traffic Coatings: 100 g/l less water and less exempt compounds.
34) Waterproofing Sealers: 100 g/l less water and less exempt compounds.
35) Waterproofing Concrete/Masonry Sealers: 100 g/l less water and less exempt compounds.
36) Wood Preservatives: 350 g/l less water and less exempt compounds.
37) Low-Solids Coating: 120 g/L.
38) Architectural Coatings, excluding IM Coatings: 50 g/l less water and less exempt compounds.
39) Solvent-Based IM: 600 g/l less water and less exempt compounds.
40) Waterborne IM: 50 g/l less water and less exempt compounds.

C. Credit IEQ 4.3: Low-Emitting Materials - Flooring Systems:

1. All flooring must comply with the following as applicable to the Project scope:

a. All carpet installed in the building must meet the testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
b. All carpet cushion installed in the building interior must meet the requirements of the Carpet and Rug Institute Green Label program.
c. All carpet adhesive must meet the requirements of IEQ Credit 4.1: Adhesives and Sealants, which includes a volatile organic compound (VOC) limit of 50 g/L.
d. All hard surface flooring must meet the requirements of the FloorScore standard (current as of the date of the LEED 2009 for New Construction & Major Renovations 2009 Edition, or more stringent version) as shown with testing by an independent third-party. Mineral-based finish flooring products such as tile, masonry, terrazzo, and cut stone without integral organic-based coatings and sealants and unfinished/untreated solid wood flooring qualify for credit without any IAQ testing requirements. However, associated site-applied adhesives, grouts, finishes, and sealers must be compliant for a mineral-based or unfinished/untreated solid wood flooring system to qualify for credit.
e. Concrete, wood, bamboo, and cork floor finishes such as sealer, stain, and finish, must meet the requirements of South Coast Air Quality Management District (SCAQMD) Rule 1168, Architectural Coatings, rules in effect on January 1, 2004.
f. Tile setting adhesives and grout must meet South Coast Air Quality Management District (SCAQMD) Rule 1168. VOC limits correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005.

D. IEQ Credit 4.4: Low-Emitting Materials - Composite Wood and Agrifiber: Composite wood and agrifiber products used on the interior of the building (i.e., inside of the weatherproofing system) must contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies must not contain added urea-formaldehyde resins.

1. Materials considered fixtures, furniture, and equipment (FF&E) are not considered base building elements and are not included.

PART 3 - EXECUTION

3.1 CONSTRUCTION ACTIVITY POLLUTION PREVENTION

A. SS Prerequisite 1: Construction Activity Pollution Prevention: Refer to erosion and sedimentation control requirements as indicated on the Drawings.

1. Over the course of site work activities, document implementation of the erosion and sedimentation control plan through date-stamped photos, inspection logs or reports, descriptions of corrective action in response to problems, etc. Input documentation requirements as required by LEED-Online template for this prerequisite.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. MR Credit 2: Construction Waste Management: Comply with Section 01 74 19 "Construction Waste Management and Disposal."

3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

A. IEQ Credit 3.1: Construction Indoor Air Quality Management Plan - During Construction:

1. Develop and implement an indoor air quality (IAQ) management plan for the construction and preoccupancy phases of the building as follows:

a. During construction, meet or exceed the recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline For Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).
b. Protect stored on-site and installed absorptive materials from moisture damage.
c. If permanently installed air handlers are used during construction, filtration media with a minimum efficiency reporting value (MERV) of 8 must be used at each return-air grille, as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda).
d. Replace all filtration media immediately prior to occupancy.

2. Documentation:

a. Create a written construction IAQ management plan for use during construction.
b. Maintain a detailed photo log of the construction IAQ management plan practices followed during construction.
c. Refer to LEED Online and the Reference Guide for the complete descriptions of all required documentation.

B. IEQ Credit 3.2: Indoor Air Quality Management Plan - Before Occupancy:

1. Implement an indoor air quality (IAQ) management plan after all finishes have been installed and the building has been completely cleaned before occupancy. Comply with one of the following requirements:

a. After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and perform a building flush-out by supplying a total volume of 14,000 cubic feet of outdoor air per square foot of floor area while

maintaining an internal temperature of at least 60 deg F and relative humidity no higher than 60 percent.

1) <**Insert operating requirements**>.

b. If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cubic feet of outdoor air per square foot of floor area. Once a space is occupied, it must be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot of outside air or the design minimum outside air rate determined in IEQ Prerequisite 1: Minimum Indoor Air Quality Performance, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of three (3) hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot of outside air has been delivered to the space.

1) <**Insert operating requirements**>.

c. Air-Quality Testing:

1) Conduct baseline indoor-air-quality (IAQ) testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air and as additionally detailed in the LEED Reference Guide for Green Building Design and Construction, 2009 Edition.
2) Demonstrate that the contaminant maximum concentrations listed in table below are not exceeded:

Contaminant	Maximum Concentration
Formaldehyde	27 parts per billion
Particulates (PM10)	50 micrograms per cubic meter
Total volatile organic compounds (TVOCs)	500 micrograms per cubic meter
4-Phenylcyclohexene (4-PCH)*	6.5 micrograms per cubic meter
Carbon monoxide (CO)	9 part per million and no greater than 2 parts per million above outdoor levels
* This test is required only if carpets and fabrics with styrene butadiene rubber (SBR) latex backing are installed as part of the base building systems.	

3) For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the noncompliant concentrations. Repeat until all requirements are met. When retesting noncompliant building areas, take samples from same locations as in the first test, although it is not required.
4) Conduct the air-sample testing as follows:

a) All measurements must be conducted prior to occupancy but during normal occupied hours with the building ventilation system started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the test.
b) All interior finishes must be installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Movable furnishings

such as workstations and partitions should be in place for the testing, although it is not required.

c) The number of sampling locations will depend on the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points must not be less than one (1) per 25,000 square feet or for each contiguous floor area, whichever is larger. Include areas with the least ventilation and greatest presumed source strength.

d) Air samples shall be collected between three (3) and six (6) feet from the floor to represent the breathing zone of occupants, and over a minimum four (4) hour period.

2. Documentation:

a. Maintain a written construction IAQ management plan.
b. For projects completing a flush-out procedure, record dates, occupancy, outdoor air delivery rates, internal temperature, and humidity, as well as any special considerations.
c. Refer to LEED Online and the Reference Guide for the complete descriptions of all required documentation.

3.4 LEED DOCUMENTATION

A. Within thirty (30) calendar days after the date established for Substantial Completion of the Work, provide required documentation for the Project to GBCI using LEED Online including, but not limited to, templates, product data sheets, cut sheets, and manufacturers' LEED letters for all LEED prerequisites and credits identified as the Contractor's responsibility in this Section and elsewhere in the Contract Documents.

END OF SECTION 01 81 13.13

LEED 2009 for New Construction and Major Renovations

Project Checklist

Eastern Family Resource Center

June 16 2015

Sustainable Sites — Possible Points: 26

Y	?	N			
Y			Prereq 1	Construction Activity Pollution Prevention	
1			Credit 1	Site Selection	1
5			Credit 2	Development Density and Community Connectivity	5
		1	Credit 3	Brownfield Redevelopment	1
	6		Credit 4.1	Alternative Transportation—Public Transportation Access	6
1			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
3			Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
		2	Credit 4.4	Alternative Transportation—Parking Capacity	2
1			Credit 5.1	Site Development—Protect or Restore Habitat	1
1			Credit 5.2	Site Development—Maximize Open Space	1
	1		Credit 6.1	Stormwater Design—Quantity Control	1
1			Credit 6.2	Stormwater Design—Quality Control	1
		1	Credit 7.1	Heat Island Effect—Non-roof	1
1			Credit 7.2	Heat Island Effect—Roof	1
	1		Credit 8	Light Pollution Reduction	1

Water Efficiency — Possible Points: 10

Y	?	N			
Y			Prereq 1	Water Use Reduction—20% Reduction	
4			Credit 1	Water Efficient Landscaping	2 to 4
		2	Credit 2	Innovative Wastewater Technologies	2
2	1	1	Credit 3	Water Use Reduction	2 to 4

Energy and Atmosphere — Possible Points: 35

Y	?	N			
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
5	3	11	Credit 1	Optimize Energy Performance	1 to 19
1		6	Credit 2	On-Site Renewable Energy	1 to 7
2			Credit 3	Enhanced Commissioning	2
2			Credit 4	Enhanced Refrigerant Management	2
		3	Credit 5	Measurement and Verification	3
2			Credit 6	Green Power	2

Materials and Resources — Possible Points: 14

Y	?	N			
Y			Prereq 1	Storage and Collection of Recyclables	
		3	Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
		1	Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
2			Credit 2	Construction Waste Management	1 to 2
		2	Credit 3	Materials Reuse	1 to 2

Materials and Resources, Continued

Y	?	N			
2			Credit 4	Recycled Content	1 to 2
2			Credit 5	Regional Materials	1 to 2
		2	Credit 6	Rapidly Renewable Materials	1
1			Credit 7	Certified Wood	1

Indoor Environmental Quality — Possible Points: 15

Y	?	N			
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1			Credit 1	Outdoor Air Delivery Monitoring	1
	1		Credit 2	Increased Ventilation	1
1			Credit 3.1	Construction IAQ Management Plan—During Construction	1
1			Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
1			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
1			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
1			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
1			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
1			Credit 5	Indoor Chemical and Pollutant Source Control	1
	1		Credit 6.1	Controllability of Systems—Lighting	1
		1	Credit 6.2	Controllability of Systems—Thermal Comfort	1
1			Credit 7.1	Thermal Comfort—Design	1
		1	Credit 7.2	Thermal Comfort—Verification	1
		1	Credit 8.1	Daylight and Views—Daylight	1
		1	Credit 8.2	Daylight and Views—Views	1

Innovation and Design Process — Possible Points: 6

?	?				
1			Credit 1.1	Exemplary Performance - 100% Green Power for 2 years	1
1			Credit 1.2	Green Cleaning	1
	1		Credit 1.3	Contractor Exemplary Performance - MR2, MR4 or MR5	1
	1		Credit 1.4	Contractor Exemplary Performance - MR2, MR4 or MR5	1
	1		Credit 1.5	Contractor Exemplary Performance - MR2, MR4 or MR5	1
1			Credit 2	LEED Accredited Professional	1

Regional Priority Credits — Possible Points: 4

?	?				
1			Credit 1.1	Regional Priority: SSc6.2 Stormwater design - quality control	1
1			Credit 1.2	Regional Priority: EAc2 On-site renewable energy	1
	1		Credit 1.3	Regional Priority: SSc4.1 Alternative transportation - public transporta	1
1			Credit 1.4	Regional Priority: SSc5.1 protect or restore habitat	1

54	18	39	**Total**	**Possible Points:**	**110**

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 230800 – Commissioning of HVAC

B. Section 260800 – Commissioning of Electrical Systems

1.2 SUMMARY

A. This section includes:

1. Commissioning: Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the Owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance, and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control systems calibration, testing and balancing, performance testing and training.

2. Commissioning during the construction phase is intended to achieve the following specific objectives according to the contract documents:

   a. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.

   b. Verify and document proper performance of equipment and systems.

   c. Verify that O&M documentation left on site is complete.

   d. Verify that the Owner's operating personnel are adequately trained.

3. The commissioning process does not take away from or reduce the responsibility of the contractor to meet the Contract Documents.

1.3 ABBREVIATIONS

A. Abbreviations: the following are common abbreviations used in this Specification and in the commissioning plan.

A/E	Architect and design engineers	GC	General Contactor

CA	Commissioning authority	IC	Installing Contractor
PFC	Pre-Functional Checklist	MC	Mechanical Contractor
CT	Commissioning Team	RTF	Resolution Tracking Form
Cx	Commissioning	Subs	Subs to Prime Contractors
Cx Plan	Commissioning Plan document	TAB	Testing and Balance Contractor
EC	Electrical Contractor	TCC	Temperature Controls Contractor
FPT	Functional Performance Test		

1.4 COORDINATION

A. Commissioning Team the members of the commissioning team consist of the CA, the GC, the Architect and Design Engineers (particularly the Mechanical Engineer), the MC, the EC, the TAB representative, the TCC, and any other installing subs or suppliers of equipment. If known, the Owner's building or plant operator/engineer is also a member of the commissioning team.

B. Management: The CA directs and coordinates the commissioning activities and reports to the Owner. All members work together to fulfill their contracted responsibilities and meet the objectives of the contract Documents. The CA's responsibilities are the same regardless of who hired the CA.

C. Scheduling: The CA will work with the GC according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice (generally two weeks' notice) to the GC for scheduling activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

D. The CA will provide the initial schedule of primary commissioning events, or commissioning milestones, at the initial commissioning meeting. The Commissioning Plan provides a format for this schedule. As construction progresses and more detailed schedules are available from the GC, the CA will adjust the commissioning schedule accordingly.

1.5 COMMISSIONING PROCESS

A. Commissioning Plan: The commissioning plan provides guidance in the execution of the commissioning process. The Specifications will take precedence over the Commissioning Plan.

B. Commissioning Process: The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

1. Commissioning during construction begins with an initial Commissioning meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.

2. Additional meeting will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, coordinate, schedule future activities and resolve problems.

3. Equipment documentation is distributed by the A/E to the CA during the normal submittal process, including detailed start-up procedures.

4. The CA works with the Contractor in each discipline in developing startup plans and startup documentation formats, including providing the Contractor with

construction checklists to be completed during the installation and startup process.

5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with construction checklists being completed before functional testing occurs.

6. The Contractors, under their own direction, will execute and document the completion of construction checklists and perform startup and initial checkout. The CA documents that checklists and startup were completed according to the approved plans.

7. The CA develops specific equipment and system functional performance test procedures.

8. The functional test procedures are reviewed with the A/E, CA, and Contractors.

9. The functional testing and procedures are executed by the Contractors under the direction of, and documented by the CA.

10. During initial functional tests and for critical equipment, the Engineer will witness the testing.

11. Items of non-compliance in material, installation, or setup are corrected at the Contractor's expense, and the system is retested.

12. The CA reviews the O&M documentation for completeness.

13. The project will not be considered substantially complete until the conclusion of Commissioning functional testing procedures as defined in the Commissioning Plan.

14. The CA reviews the training provided by the Contractors and verifies that it was completed.

1.6 RESPONSIBILITIES

A. The responsibilities of various parties in the commissioning process are provided in this section.

B. All Parties:
   1. Follow the Commissioning Plan
   2. Attend an initial commissioning meeting and additional meetings, as necessary.

C. General Contractor (GC)

   1. Construction and Acceptance Phase:

      a. Facilitate the coordination of the commissioning work by the CA, and with the GC and CA, ensure that commissioning activates are being scheduled into the master schedule.

      b. Include the cost of commissioning in the total contract price.

      c. Furnish a copy of all construction documents, addenda, change orders, approved submittals and shop drawings related to commissioned equipment to the CA.

      d. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks, and training.

e. Ensure that all Contractors execute their commissioning responsibilities according to the Contract Documents and schedule.

f. A representative shall attend the initial commissioning meeting and other necessary meeting scheduled by the CA to facilitate the Cx process.

g. Coordinate and schedule the training of owner personnel.
   1) Prepare O&M manuals, according to the Contract documents, including clarifying an updating the original sequences of operation to as-built conditions.

h. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the owner to keep warranties in force.

i. Assist in equipment testing per agreements with sub-contractors.

j. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CA.

k. Supply and analyze specified products to verify that the Designer has specified the newest most updated equipment reasonable for this project's scope and budget.

l. Provide information requested by CA regarding equipment sequence of operations of operation and testing procedures.

   1) Review test procedures for equipment installed by factory representatives.

m. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

n. Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.

1.7 DEFINITIONS

A. Acceptance Phase: Phase of construction after startup and initial checkout when functional performance tests, O&M documentation review, and training occur

B. Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents

C. Architect / Engineer (A/E): The prime consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer

D. Commissioning Authority (CA): An independent authority, not otherwise associated with the A/E team members or the Contractor, though he/she may be hired as a subcontractor to them. The CA does not take an oversight role.

E. Commissioning Plan: An overall plan, developed before or after bidding that defines the structure, schedule, and coordination planning for the commissioning process.

F. Pre-functional Checklist: A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Sub. Construction checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension correct, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some construction checklist items entail simple testing of the function of a component, a piece of equipment, or system. The Pre-functional checklists augment and are combined with the manufacturer's start-up checklist. Even without a commissioning process, Contractors typically perform some, if not many, of the construction checklist items a commissioning authority will recommend. However, few Contractors document in writing the execution of these checklist items. Therefore, for most equipment, the Contractors execute the checklists on their own. The Commissioning Authority only requires that the procedures be documented in writing and does not witness much of the completion of construction checklists, except for larger or more critical pieces of equipment.

G. Contract Documents: The documents binding on parties involved in the construction of this Project (drawings, specifications, change orders, amendments, contracts, etc.)

H. Contractor: The general contractor or authorized representative

I. Control system: The central building energy management control system

J. Data Logging: Monitoring flows, current status, pressures, etc. of equipment using stand-alone data loggers separate from the control system

K. Deferred Functional Tests: FPTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design, or other site conditions that percent the test from being performed

L. Deficiency: A condition in the installation of function of a component, piece of equipment or system that is not in compliance with the Contract Documents

M. Factory Testing: Testing of equipment on-site or at the factory by factory personnel with a Project Manager present

N. Functional Performance Test (FPT): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, high loads, component failures, unoccupied, varying outside air temperatures, power failure, etc. The systems are run through all the control system's sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The Commissioning Agent develops the functional test procedures in a sequential written form, coordinates, oversees, and documents the actual testing. FPTs are performed after construction checklists and startups are complete.

O. General Contractor (GC): The Contractor for this project. Generally refers to all GC's subs as well. Also referred to as the Contractor, in some contexts.

P. Indirect Indicators: Of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.

Q. Installing Contractor: Contractor who installs specific equipment and/or systems

R. Manual Test: Using hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”)

S. Monitoring: the recording of parameters (flow, current, status, pressure, etc.) of equipment operations using data loggers or the trending capabilities of control systems

T. Non-Compliance: See Deficiency

U. Non-Conformance: See Deficiency

V. Over-written value: Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50°F to 75°F to verify economizer operation). See also “Simulated Signal.”

W. Owner-Contracted Tests: Tests paid for by the Owner outside the GC’s contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.

X. Phased Commissioning: Commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time

Y. Sampling: Functionally testing only a fraction of total number of identical or near-identical pieces of equipment. Refer to Part 3, Paragraph 3.4 F for details.

Z. Seasonal Testing: Tests that are deferred until the system(s) will experience conditions closer to their design conditions.

AA. Simulated Condition: Condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box)

BB. Specifications: The construction specifications of the Contract Documents

CC. Startup: The initial starting or activating of dynamic equipment, including executing construction checklists

DD. Subs: the subcontractors to the Prime Contractor who provide and install building components and systems.

EE. Test Procedures: The step-by-step process that must be executed to fulfill the test requirements. The CA develops the Test procedures.

FF. Test Requirements: Requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements for each system are specified in the respective section of the Contract Documents.

GG. Trending: Monitoring using the building control system

HH. Vendor: Supplier of equipment

II. Warranty Period: Warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.8 SYSTEMS TO BE COMMISSIONED

A. The following checked systems are to be commissioned.

HVAC Equipment and System
(X) VAV Boxes
(X) Hydronic Piping systems
(X) HVAC Pumps
(X) Boilers
(X) Air Cooled Chiller
(X) Makeup Air Systems
(X) Air Handling Units
(X) Exhaust Fans
(X) Ductwork
(X) Fire/Smoke Dampers
(X) Automatic Temperature Controls – Including an intentional sequence of operation
(X) Testing, Adjusting, and Balancing
(X) Chillers
(X) Supply Fans
(X) Return Fans
(X) Coils
(X) Rooftop Packaged AHU's with Gas Heat
(X) Split Systems
(X) Dryer Exhaust System
(X) Solar System

Electrical Equipment and System
(X) Lighting Control Systems
(X) Lighting Control Programs
(X) Diesel Generator, ATS and associated generator supplied electrical distribution system
(X) Power distribution system switchboards
(X) Automatic control systems for mechanical and electrical equipment including automatic starters and VFD's.

Plumbing System
(X) Domestic Water Heater

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Installing Contractor (IC) for the equipment being tested.

B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents, shall be included in the base bid price to the Contractor and left on site, except for stand-alone data logging equipment that may be used by the CA.

C. Temporary Data logging equipment and software required to test equipment will be provided by the CA but shall not become the property of the Owner.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital

thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or – 0.1°F. Pressure sensors shall have an accuracy of + or – 2.0% of the value range being measured (not full range or meter) and have been calibrated with in the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

E. Refer to Part 3 for details regarding equipment that may be required to simulate required test conditions

PART 3 - EXECUTION

3.1 MEETINGS

A. Commissioning Meeting: Prior to mechanical rough in, the CA will schedule, plan and conduct a commissioning meeting with the entire commissioning team in attendance.

B. Miscellaneous meetings: Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular contractors. The CA will plan these meetings and minimize unnecessary time being spent by the contractors.

3.2 STARUP, PRE-FUNCTIONAL CHECKLISTS, AND INITIAL CHECKOUT

A. The following procedures apply to all equipment to be commissioned. Some systems that are not comprised so much of actual dynamic machinery, may have very simple PFCs and startup.

B. General: Pre-functional checklists are important to ensure that the equipment and systems are hooked up correctly and operational. Checklists also ensure that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full construction checkout. No sampling strategies are used. The construction testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

C. Startup and Initial Checkout Plan: The CA will assist the commissioning team members responsible for startup of any equipment in developing detailed startup plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures has been completed. Parties responsible for construction checklists and startup are identified in the initial commissioning meeting and in the checklist forms.

1. The CA adapts, if necessary, the representative construction checklists and procedures from the related sections. These checklists indicate required procedures to be executed as part of startup and initial check out of the systems and the party responsible for their execution.

2. The CA provides these checklists and tests to the Contractor. The Contractor determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form will have more than one trade responsible for its execution.

3. The Contractor responsible for the purchase of the equipment develops the full startup plan by combining (or adding to) the CA's checklists with the manufacturer's detailed startup and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.

    a. The startup plan shall consist of the following at a minimum:
        1) The CA's Pre-functional Checklists
        2) The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end
        3) The manufacturer's normally used field checkout sheets

D. Sensor and Actuator Calibration

1. All field-installed temperature, relative humidity, CO, CO2, and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used if approved by the CA beforehand. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed in the unit at the factory with calibration certification provided need not be field-calibrated.

2. All procedures used shall be fully documented on the Pre-functional checklists or other approved forms, clearly referencing the procedures followed and written documentation of initial, intermediate, and final results.

3. Sensor Calibration Methods

    a. All Sensors: Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end. For sensor pairs that are used to determine a temperature of pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading of each other for pressure. Tolerances for critical applications may be tighter.

    b. Sensors Without Transmitters—Standard Application: Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage, or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.

    c. Sensors with transmitters—Standard Application: Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until the ammeter reads 4 mA. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform to specified control ramps, reset schedules, proportional relationship, reset relationship, and P/I reaction. Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage, or building automation system [BAS]) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For

pressure sensors, perform a similar process with a suitable signal generator.

4. Tolerances, Standard Applications

Sensor	Required Tolerance (+/-)		Sensor	Required Tolerance (+/-)
Cooling coil, CW, CHW, temps	0.4°F		Flow rates, Relative humidity	4% of design
AHU wet bulb or dew point	2.0°F		Combustion flue temps	5.0°F
OA, space air, duct air temps	0.4°F		CO monitor	0.01 % pts
Watt-hour, volt and amp	1% of design		Natural gas and oil flow rate	1% of design
Pressures, air, water and gas	3% of design		Steam flow rate	3% of design
Flow rates, air	10% of design		Barometric pressure	0.1 in. of Hg

5. Valve and Damper Stroke Setup and Check

   a. EMS Readout: For all valve and damper actuator positions checked, verify the actual position against the BAS readout.

   b. Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, replace actuator or add pilot position indicator (for pneumatics).

   c. Closure for heating coil valves (NO): Set heating setpoint 20°F above room temperature. Observe the valve open. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set heating setpoint to 20°F below room temperature. Observe the valve close. For pneumatics, by 3 psi (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change. Restore to normal.

   d. Closure for cooling coil valves (NC): Set cooling setpoint 20°F above room temperature. Observe the valve close. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set cooling setpoint to 20°F below room temperature. Observe valve open. For pneumatics, by override in the EMS, increase pressure to valve by 3 psi (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change. Restore to normal.

E. Execution of Pre-Functional Checklists and Startup

1. Four weeks prior to startup, the contractors and vendors schedule startup and checkout with the GC and CA. The performance of the construction checklists, startup and checkout are directed and executed by the contractor or vendor.

When checking off construction checklists, signatures may be required of other contractors for verification of completion of their work.

2. The CA will, at their own discretion, observe, at minimum, the procedures for each piece of primary equipment unless there are multiple units.

3. For lower-level components of equipment, (e.g., VAV boxes, sensors, controllers), the CA shall observe a sampling of the construction and startup procedures.

4. The contractors shall execute startup and provide the CA with a signed and dated copy of the completed startup and construction tests and checklists.

5. Only installing individuals who have direct knowledge that a line item task on the construction checklist was actually performed shall initial or check off that item.

F. Deficiencies, Non-Conformance and Approval in Checklists and Startup

1. The contractors shall clearly list any outstanding items of the initial startup and construction procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.

2. The CA reviews the report and submits either a non-compliance report or an approval form to the contractors. The installing contractors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated startup report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CA recommends approval of the execution of the checklists and startup of each system to the A/E using a standard form.

3. Items left incomplete, which later cause deficiencies or delays during functional testing, may result in back charges to the responsible party.

3.3 PHASED COMMISSIONING

A. If the project requires startup and initial checkout to be executed in phases. This phasing will be planned and scheduled in a coordination meeting of the CA, MC, TAB, TCC and the GC. Results will be added to the master and commissioning schedule.

3.4 FUNCTIONAL PERFORMANCE TESTING

A. This subsection applies to all commissioning functional testing for all divisions.

B. Objectives and Scope: The objective of functional performance testing is to demonstrate that each system is operating according to the Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

1. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be

tested. Specific modes required in this project are given in individual specifications.

C. Development of Test Procedures: Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements in individual specifications, and elsewhere, the CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each contractor or vendor responsible to execute a test shall provide limited assistance to the CA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the contractors, who shall review the tests for feasibility, safety, equipment, and warranty protection.

1. The CA shall review Owner-contracted factory testing or required Owner acceptance tests which the CA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the Specifications. Redundancy of testing shall be minimized.

2. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

3. The test procedure forms developed by the CA shall include (but not be limited to) the following information:
   a. System and equipment or component name(s)
   b. Equipment location and ID number
   c. Unique test ID number, and reference to unique construction checklist and start-up documentation ID numbers for the piece of equipment
   d. Date
   e. Project name
   f. Participating parties
   g. Formulas used in any calculations
   h. Required pre-test field measurements
   i. Specific step-by-step procedures to execute the test, in a clear, sequential, and repeatable format
   j. Acceptance criteria of proper performance with a Yes / No checkbox to allow for clearly marking whether or not proper performance of each part of the test was achieved
   k. A section for comments
   l. Signatures and date block for the CA

D. Test Methods

1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data loggers. The CA may substitute specified methods or require an additional method to be executed other than what was specified. The CA will determine which method is most appropriate for tests that do not have a method specified.

2. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.

3. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be

something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable, e.g., for the above case, by heating the outside air sensor with a hair dryer rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers, and devices shall have been calibrated.

4. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.

5. Altering Setpoints: Altering setpoints to test a sequence is acceptable.

6. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses.

7. Setup: Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. At completion of the test, the contractor shall return all affected building equipment and systems to their pre-test condition.

8. Sampling: Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by contractors are allowed in Pre-functional checklist execution.

    a. The example below describes a 20% Sampling—10% Failure Rule.

        1) Randomly test at least 20% of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the “first sample.”

        2) If 10% of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).

        3) If 10% of the units in the second sample fail, test all remaining units in the whole group.

        4) If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and require the contractor to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

E. Coordination and Scheduling: The contractors shall provide sufficient notice to the CA regarding their completion schedule for the construction checklists and startup of all equipment and systems. The CA will schedule functional tests through the A/E, GC and other contractors. The CA shall direct, witness and document the functional testing of all equipment and systems. The contractors shall execute the tests.

1. In general, functional testing is conducted after construction testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other

components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

F. Problem Solving: The CA will recommend solutions to problems found; however, the burden of responsibility to solve, correct, and retest problems is with the GC, contractors, and A/E.

3.5 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation: The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the contractors for review. The CA will include the filled-out forms in the system manual.

B. Non-Conformance

1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the A/E on a standard non-compliance form or site visit report.

2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.

3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner.

4. As testing progresses and deficiencies are identified, the CA discusses the issue with the executing contractor.

   a. When there is no dispute on the deficiency and the contractor accepts responsibility to correct it:

      1) The CA documents the deficiency and the contractor's response and intentions, and they go on to another test or sequence. After the day's work, the CA submits the non-compliance reports to the A/E for signature, if required. A copy is provided to the contractor and CA. The contractor corrects the deficiency, and certifies that the equipment is ready to be retested.

      2) The contractor reschedules the test and coordinates with CA to establish a time and date that the test is to be repeated.

   b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

      1) The deficiency shall be documented on the non-compliance form with the contractor's response and a copy given to the A/E and to the contractor representative assumed to be responsible.

      2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final

interpretive authority is with the A/E. Final acceptance authority is with the A/E.

3) The CA documents the resolution process.

4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The contractor reschedules the test and notifies the CA of the date and time the test is to be repeated. This will occur until satisfactory performance is achieved.

5. Cost of Retesting

   a. The cost for the contractor to retest a construction or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the responsible parties.

   b. For a deficiency identified, not related to any construction checklist or startup fault, the following shall apply: The CA will direct the retesting of the equipment once at no “charge” to the contractor for their time. However, the CA’s time for a second retest will be charged to the contractor.

   c. The time for the CA to direct any retesting required because a specific construction checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back charged to the contractor.

6. The contractor shall respond in writing to the CA at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

7. The CA retains the original non-conformance forms until the end of the project.

8. Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the contractor.

C. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the Owner. In such case, the contractor shall provide the Owner with the following:

1. Within one week of notification from the A/E, the contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the A/E within two weeks of the original notice.
2. Within two weeks of the original notification, the contractor shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions, which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
3. A/E will determine whether replacement of all identical units or a repair is acceptable.
4. Two examples of the proposed solution will be installed by the contractor and the CA will be allowed to test the installations for up to one week, upon which the CA will decide whether to accept the solution.

5. Upon acceptance, the contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

D. Approval: The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA. The CA recommends acceptance of each test to the Owner and A/E using a standard form. The A/E gives final approval on each test using the same form, providing a signed copy to the CA and the contractor.

3.6 SYSTEMS MANUAL

A. The systems manual expands the scope of the traditional operating and maintenance documentation to include the additional information gathered during the Commissioning Process and to provide a systems-based organization of information.

B. The systems manual contains multiple documents and is the responsibility of the GC with help from the subs to put together and the responsibility of the CA to review for completeness. The Commissioning plan contains a description and list of all documents needed in the systems manual. The documents include the following:

1. The final version of the Basis of Design
2. System single-line diagrams
3. As-built sequences of operations, control drawings, and original set points
4. Operating instructions for integrated building systems
5. Recommended schedule of maintenance requirements and frequency, if not already included in the O&M manuals
6. Recommended schedule for calibrating sensors and actuators

C. Standard O&M Manuals.

1. Special requirements for the TCC and TAB contractor are found in Section23 08 00.

3.7 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

1. In addition to these general requirements, the specific training requirements of Owner personnel by Contractor and vendors are specified in individual sections.
2. Each contractor and vendor responsible for training will create a written training plan. The plan will cover the following elements:
    a. Equipment (included in training)
    b. Intended audience
    c. Location of training

d. Objectives

e. Subjects covered (description, duration of discussion, special methods, etc.)

f. Duration of training on each subject

g. Instructor for each subject

h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)

i. Instructor and qualifications

3. For the primary HVAC equipment, the TCC shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.

4. The GC will provide videotaping of the training sessions, with tapes cataloged by the GC, and added to the O&M manuals.

3.8 DEFFERRED TESTING

A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition, or other deficiency, execution of checklists and functional testing may be delayed upon approval of the A/E.

B. Seasonal Testing: During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) specified in Division 23 shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed and documented, and any deficiencies corrected by the appropriate contractor, with facilities staff and the CA witnessing.

3.9 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in various parts of the Specifications. The Commissioning Plan lists all the formal written work products describes briefly their contents.

END OF SECTION 01 91 13

DIVISION 03 – CONCRETE

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product Data: For each type of product**,** including the following:

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.
2. Product Certificates: For products and materials which comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project and fraction by weight that is considered regional. (For information only)

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. Submit for each concrete mix not less than 15 days prior to placing concrete.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Qualification Data: For Installer, manufacturer and testing agency.

E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements: (For information only)

1. Cementitious materials and aggregates.
2. Form materials and form-release agents.
3. Steel reinforcement and reinforcement accessories.
4. Admixtures.
5. Curing materials.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Repair materials.

G. Product Certificates: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project and fraction by weight that is considered regional. (For information only)

H. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

I. Field quality-control test and inspection reports.

J. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete,"
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.

B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

2.3 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 90 percent.

B. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars. Cut bars true to length with ends square and free of burrs.

2.5 CONCRETE MATERIALS

A. Regional Materials: Concrete shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C 150, Type I.

C. Blended Hydraulic Cement: ASTM C 595M, Type IS, portland blast-furnace slag cement.

D. Normal-Weight Aggregate: ASTM C 33, uniformly graded.

E. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size.

F. Water: Potable and complying with ASTM C-94.

2.6 ADMIXTURES

A. AIR-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture:
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing Retarding Admixture: ASTM C 101/C, Type II.

C. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Available Products:

a. Axim Concrete Technologies; Catexol 1000CI.
b. Boral Material Technologies, Inc.; Boral BCN2.
c. Cortec Corporation; MCI 2005NS.
d. Grace Construction Products, W. R. Grace & Co.; DCI-S.
e. Master Builders, Inc.; Rheocrete 222+.
f. Sika Corporation; FerroGard-901.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E1745, Class C. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Raven Industries, Inc.; Vapoer Block VB10.
b. Reef Industries, Inc.; Griffolyn Type-65.
c. Stego Industries, LLC; Stego Wrap, 10 mil Class C.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products:

a. BASF Construction Chemicals - Building Systems; Confilm.
b. ChemMasters, Inc.; Spray-Film.
c. Dayton Superior; AquaFilm.
d. Euclid Chemical Company (The); an RPM company; Eucobar.
e. L&M Construction Chemicals, Inc.; E-CON.
f. SpecChem; Spec Film.
g. W.R. Meadows, Inc.; EVAPRE.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Corporation-Construction Systems; MasterKure CC 1315 (Pre-2014: Kure 1315).
b. ChemMasters, Inc.; Polyseal WB.
c. Dayton Superior; Cure & Seal 1315 EF.
d. Euclid Chemical Company (The); an RPM company; Super Diamond Clear VOX.
e. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
f. SpecChem, LLC; Cure & Seal WB 25.
g. W. R. Meadows, Inc.; Vocomp-30.

2. VOC Content: Curing and sealing compounds used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must meet the requirements of South Coast Air Quality Management District (SCAQMD) Rule 1113. Architectural Coatings, rules in effect on January 1, 2004, shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)..

2.9 RELATED MATERIALS

A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

C. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Footings, Piers, and Walls: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 3000 psi (20.7 MPa).
2. Maximum Slump: 4 inches (100 mm).

3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches (200 mm) after admixture is added to concrete with 2- to 4-inch (50- to 100-mm) slump.

D. Slab-on-Grade: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 3500 psi (24.1 MPa).
2. Maximum Slump: 4 inches (100 mm).

E. Suspended Slabs: Proportion structural lightweight concrete mix as follows:

1. Compressive Strength (28 Days): 3500 psi (31.0 MPa).
2. Calculated Equilibrium Unit Weight: 115 lb/cu. ft. plus or minus 3 lb/cu. ft. as determined by ASTM C 567.
3. Maximum Slump: 4 inches (100 mm).

F. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete exposed to deicers or subject to freezing and thawing while moist.

G. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in exterior exposed concrete at point of placement having an air content of 5 to 7 percent, unless otherwise indicated.

H. Do not air entrain concrete to trowel-finished interior floors. Do not allow entrapped air content to exceed 3 percent.

I. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

J. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures for concrete exposed to weather.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete, unless indicated otherwise.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing plus 2 inches. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Unless indicated on drawings, space vertical joints in walls at maximum 30 feet. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface: See specification section 03 35 13 High-Tolerance Concrete Floor Finishing.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

F. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in 1 or 2 applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.11 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

3. Curing and Sealing Compound: Apply uniformaly to floors and slabs indicated in a continuous operation by power spray or roler according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or

that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor shall engage and pay for a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

8. Test results shall be reported in writing to Architect, Structural Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

9. When testing strength of cured cylinders is less than specified strength, Structural Engineer should review and advice whether concrete in place is acceptable or not. Contractor shall evaluate operations and provide corrective procedures.

10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect or Engineer but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 03 30 00

SECTION 03 33 00

ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place architectural concrete, including form facings, reinforcement and accessories, concrete materials, concrete mixture design, placement procedures, and finishes.

1. Requirements in Section 03 30 00 "Cast-in-Place Concrete" apply to architectural concrete.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for formwork; material, expansion joint filler, fabrication, casting, curing, steel reinforcement, and installation requirements for steel reinforcement; and field quality control.

1.3 DEFINITIONS

A. Cast-in-Place Architectural Concrete: Formed concrete that is exposed to view on surfaces of completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.

B. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural concrete.

C. Reveal: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

2. For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements. For each design mixture submitted, include an equivalent concrete mixture that does not contain portland cement replacements, to determine amount of portland cement replaced.

C. Formwork Shop Drawings: Show formwork construction, including form-facing joints, rustications, construction and contraction joints, form joint-sealant details, form tie locations and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect cast-in-place architectural concrete.

D. Placement Schedule: Submit concrete placement schedule before start of placement operations. Include locations of all joints, including construction joints.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: As indicated in Division 3 Section "Cast-in-Place Concrete".

B. Product Certificates: As indicated in Division 3 Section "Cast-in-Place Concrete".

C. Material Test Reports: As indicated in Division 3 Section "Cast-in-Place Concrete".

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Comply with Division 3 Section “Cast-in-Place Concrete”.

B. Testing Agency Qualifications: Comply with Division 3 Section “Cast-in-Place Concrete”.

C. Field sample panels may be used to verify that Contractor can produce cast-in-place architectural concrete of required finish, color, and texture. On simple projects, field samples may suffice and make mockups unnecessary. For more complex projects, field samples may be needed before producing full-scale mockups.

D. Field Sample Panels: After approval of verification sample and before casting architectural concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, cast vertically, approximately 48 by 48 by 6 inches minimum, to demonstrate the expected range of finish, color, and texture variations.

1. Locate panels as indicated or, if not indicated, as directed by Architect.
2. Demonstrate methods of curing, aggregate exposure, sealers, and coatings, as applicable.
3. In presence of Architect, damage part of an exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces.
4. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
5. Demolish and remove field sample panels, including footings, when directed.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
4. Do not use chemical accelerators unless otherwise specified and approved in design mixtures.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5 and Section 6, "Architectural Concrete."
2. ACI 303.1, "Standard Specification for Cast-in-Place Architectural Concrete."

2.2 FORM-FACING MATERIALS

A. General: Comply with Section 03 30 00 "Cast-in-Place Concrete" for formwork and other form-facing material requirements.

B. Source Limitations: Obtain each type form-facing material from single source from single manufacturer.

C. Form-Facing Panels for As-Cast Finishes: Steel- and glass-fiber-reinforced plastic, or other approved nonabsorptive panel materials that provide continuous, true, and smooth architectural concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

D. Form-Facing Panels for As-Cast Finishes: Exterior-grade plywood panels, nonabsorptive, that will provide continuous, true, and smooth architectural concrete surfaces, high-density overlay, Class 1, or better, complying with DOC PS 1.

E. Chamfer and Reveal Strips: Metal, rigid plastic, elastomeric rubber, or dressed wood, 3/4 by 3/4 inch, minimum; nonstaining; in longest practicable lengths.

F. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800; minimum 1/4 inch thick.

G. Form Joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or Type S, Grade NS, that adheres to form joint substrates.

H. Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood.

I. Anti- Graffiti Finish: An epoxy-silicone, three component, waterbased, room temperature cure coating.
   1. Low VOC coating.
   2. Acceptable Products and Manufacturers:
      a. “Wearlon” by Ecological Coating LLC. P.O. Box 4220, Clifton Park, NY- 12065
      b. “Graffiti Barier S” by Prosoco, Inc. 3741 Greenway Circle, Lawrence, KS-66046-5441

J. Form-Release Agent: Commercially formulated, colorless form-release agent that will not bond with, stain, or adversely affect architectural concrete surfaces and will not impair subsequent treatments of those surfaces.

   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

K. Surface Retarder: Chemical liquid set retarder, for application on form-facing materials, capable of temporarily delaying final hardening of newly placed concrete surface to depth of reveal specified.

L. Form Ties: Factory-fabricated, internally disconnecting ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

   1. Furnish internally disconnecting ties that will leave no metal closer than 1-1/2 inches from the architectural concrete surface.
   2. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT AND ACCESSORIES

A. General: Comply with Section 03 30 00 "Cast-in-Place Concrete" for steel reinforcement and other requirements for reinforcement accessories.

B. Recycled Content of Steel Products: Comply with Section 03 30 00 "Cast-in-Place Concrete."

2.4 CONCRETE MATERIALS

A. General: Comply with Section 03 30 00 "Cast-in-Place Concrete."

B. Regional Materials: Concrete shall be manufactured within 500 miles of Project site from aggregates that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

2.5 CURING MATERIALS

A. General: Comply with Section 03 30 00 "Cast-in-Place Concrete."

2.6 REPAIR MATERIALS

A. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

B. Epoxy Bonding Adhesive: ASTM C 881/C 881M two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements.

1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of cast-in-place architectural concrete proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed design mixtures based on laboratory trial mixtures.

B. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

D. Concrete Mixtures:

1. Compressive Strength (28 Days) (For site and ramp, walls and foundation shown on structural drawings): 4500 psi.
2. Maximum W/C Ratio: 0.45
3. Slump Limit: 4 inches, 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

2.8 CONCRETE MIXING

A. General: Comply with Section 03 30 00 "Cast-in-Place Concrete."

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. General: Comply with Section 03 30 00 "Cast-in-Place Concrete" for formwork, embedded items, and shoring and reshoring.

B. Limit deflection of form-facing panels to not exceed ACI 303.1 requirements.

C. In addition to ACI 303.1 limits on form-facing panel deflection, limit cast-in-place architectural concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch.

D. Construct forms to result in cast-in-place architectural concrete that complies with ACI 117, "Specification for Tolerances for Concrete Construction and Materials."

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-in-place surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.

1. Seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
2. Do not use rust-stained steel form-facing material.

F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

G. Chamfer exterior corners and edges of cast-in-place architectural concrete.

H. Coat contact surfaces of chamfer and reveal strips with sealer before placing reinforcement, anchoring devices, and embedded items.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 REINFORCEMENT AND INSERT INSTALLATION

A. General: Comply with Section 03 30 00 "Cast-in-Place Concrete" for fabricating and installing steel reinforcement. Securely fasten steel reinforcement and wire ties against shifting during concrete placement.

B. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.3 REMOVING AND REUSING FORMS

A. Formwork for sides of walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24

hours after placing concrete if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for cast-in-place architectural concrete surfaces.

3.4 JOINTS

A. Construction Joints: Install construction joints true to line, with faces perpendicular to surface plane of cast-in-place architectural concrete, so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
2. Form keyed joints as indicated.
3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
4. Space vertical joints in walls as indicated on Drawings.
5. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

B. Contraction Joints and Vertical Reveals: Form weakened-plane contraction joints true to line, with faces perpendicular to surface plane of cast-in-place architectural concrete, so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

3.5 CONCRETE PLACEMENT

A. General: Comply with Section 03 30 00 "Cast-in-Place Concrete."

3.6 FINISHES, GENERAL

A. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.

1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

B. Maintain uniformity of special finishes over construction joints unless otherwise indicated.

3.7 AS-CAST FORMED FINISHES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections exceeding specified limits on formed-surface irregularities. Repair and patch tie holes and defects.

B. Anti graffiti finish: Apply anti graffiti coating per manufacturers instructions and after all architectural concrete surfaces are cured and finished and approved by Architect.

3.8 CONCRETE PROTECTING AND CURING

A. General: Comply with Section 03 30 00 "Cast-in-Place Concrete."

3.9 FIELD QUALITY CONTROL

A. General: Comply with field quality-control requirements in Section 03 30 00 "Cast-in-Place Concrete."

3.10 REPAIR, PROTECTION, AND CLEANING

A. Repair and cure damaged finished surfaces of cast-in-place architectural concrete when approved by Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.

1. Remove and replace cast-in-place architectural concrete that cannot be repaired and cured to Architect's approval.

B. Protect corners, edges, and surfaces of cast-in-place architectural concrete from damage; use guards and barricades.

C. Protect cast-in-place architectural concrete from staining, laitance, and contamination during remainder of construction period.

D. Clean cast-in-place architectural concrete surfaces after finish treatment to remove stains, markings, dust, and debris.

E. Wash and rinse surfaces according to concrete finish applicator's written instructions. Protect other Work from staining or damage due to cleaning operations.

1. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural concrete finishes.

END OF SECTION 03 33 00

SECTION 03 35 13

HIGH-TOLERANCE CONCRETE FLOOR FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Finishing slabs on grade.
2. Surface treatment with concrete hardener and sealer.

1.3 REFERENCE STANDARDS

A. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.

B. ACI 302.1R – Guide for Concrete Floor and Slab Construction; American Concrete Institute.

C. ASTM E 1155 – Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness.

1.4 ACTION SUBMITTALS

A. Product Data: Provide data on concrete hardener and sealer, including information on compatibility of different products and limitations.

1. Provide documentation of VOC content in g/L for primers, sealers and floor coatings applied within the building waterproofing envelope.

1.5 INFORMATIONAL SUBMITTALS

A. Submit floor surface flatness and levelness measurements to determine compliance with specified tolerances.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Provide data on maintenance renewal of applied coatings.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

1. Maintain one copy on project site.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.9 PROJECT CONDITIONS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.10 FIELD CONDITIONS

A. Maintain ambient temperature of 50 degrees F minimum.

B. Provide ventilation sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

PART 2 - PRODUCTS

2.1 COMPOUNDS – HARDENERS AND SEALERS

A. Chemical Hardener: Clear, chemically reactive, waterborne solution of inorganic siliconate materials and proprietary components, odorless, colorless, that penetrates, hardens, and densifies concrete surfaces.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Curecrete Distribution, Inc.; Ashford Formula.
b. Euclid Chemical Company (The); an RPM company; Euco Diamond Hard.
c. L&M Construction Chemicals, Inc.; Seal Hard.

2. Provide for exterior slabs and interior slabs not receiving a subsequent finish; regardless of Finish Schedule indicating concrete hardener or not.
3. VOC Content: Not to exceed 200 g/L.

PART 3 - EXECUTION

3.1 FLOOR FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1R.

B. Steel trowel surfaces that will receive carpeting, resilient floors, seamless flooring, thin set terrazzo or thin set ceramic tile.

C. Steel trowel surfaces that are scheduled to be exposed.

D. Fine-broomed finish for exterior slabs.

3.2 FLOOR SURFACE TREATMENT

A. Apply hardener to floor surfaces in accordance with manufacturer's instructions.

3.3 TOLERANCES

A. An independent testing agency, as specified in Section 01 40 00 "Quality Requirements," will inspect finished slabs for flatness.

B. Measure for F(F) and F(L) tolerances for floors in accordance with ASTM E 1155, within 48 hours after slab installation.

C. Finish concrete to achieve the following tolerances:

1. Areas of slab-on-grade with VCT and Epoxy: Specified overall values of flatness, F(F) 35 and of levelness F(L) 25; with minimum local values of flatness, F(F) 24 and of levelness F(L) 17.
2. Areas of suspended slabs with VCT and Epoxy: Specified overall values of flatness, F(F) 30 and of levelness F(L) 20; with minimum local values of flatness, F(F) 24 and of levelness F(L) 15.
3. Areas for carpet and sealed concrete: Specified overall values of flatness F(F) 25 and of levelness F(L) 20; with minimum local values of flatness, F(F) 17 and of levelness F(L) 15.

D. Correct the slab surface if tolerances are less than specified.

E. Correct defects by grinding or by removal and replacement of defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.4 PROTECTION

A. Protect high-tolerance concrete floor finishing from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by chemical hardener manufacturer.

END OF SECTION 03 35 13

DIVISION 04 – MASONRY

SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units (CMU's).
2. Facing brick.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry-joint reinforcement.
6. Embedded flashing.
7. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

1. Cast-stone trim in unit masonry.
2. Steel lintels in unit masonry.
3. Steel shelf angles for supporting unit masonry.
4. Cavity wall insulation.

C. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for dovetail slots for masonry anchors.
2. Section 07 21 00 "Thermal Insulation" for cavity wall insulation.
3. Section 07 62 00 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
4. Section 32 32 23 "Segmental Retaining Walls" for dry-laid, concrete unit retaining walls.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type and color of exposed masonry unit and colored mortar.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence according to ASTM C 67.

2. Cementitious materials. Include name of manufacturer, brand name, and type.

3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.

4. Grout mixes. Include description of type and proportions of ingredients.

5. Reinforcing bars.

6. Joint reinforcement.

7. Anchors, ties, and metal accessories.

C. Product Certificates: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project and fraction by weight that is considered regional.

D. Manufacturers' Letters of Compatibility: Letters from manufacturers of air barrier products (specified in Section 07 27 26 "Fluid-Applied Membrane Air Barriers"), insulation in masonry construction (specified in Section 07 21 00 "Thermal Insulation"), flashing products (specified in this Section), and elastomeric sealant product specified in this Section, stating that products are compatible when installed in combination with each other.

E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.

2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.

2. Clean exposed faces of mockups with masonry cleaner as indicated.

3. Protect accepted mockups from the elements with weather-resistant membrane.

4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

6. Demolish and remove mockups, including footings, when directed by Architect unless otherwise indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.

2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

2.3 CONCRETE MASONRY UNITS

A. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners at interior applications unless otherwise indicated.

C. CMUs: ASTM C 90.

1. Density Classifications:

a. Medium weight, less than 125 to 105 lb/cu. ft., for all interior and exterior 8 inch and 12 inch walls.

b. Light weight, 105 lb/cu. ft. or less, for all interior non-load bearing 4 inch and 6 inch walls.

2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.4 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following:

1. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.

2. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout.

2.5 FACING BRICK

A. Regional Materials: Brick shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Clay Face Brick: Facing brick complying with ASTM C 216.

1. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated on Drawings or comparable product by one of the following:

a. Belden Brick Company (The).
b. Glen-Gery Corporation.
c. Redland Brick Inc.; Subsidiary of Belden Brick Company (The).

2. Grade: SW.

3. Type FBX.

4. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi.

5. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.

6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."

7. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

8. Application: Use where brick is exposed unless otherwise indicated.

2.6 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Colored Cement Products: Packaged blend made fromportland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

a. Products: Subject to compliance with requirements, provide one of the following:

1) Essroc, Italcementi Group; Flamingo-Brixment Portland Cement and Lime Blends In Color.
2) Lafarge North America Inc.; Eaglebond Portland & Lime.
3) Lehigh Hanson, Inc.; Lehigh Custom Color Portland/Lime Cement.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's full range of colors.

3. Pigments shall not exceed 10 percent of portland cement by weight.

F. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

3. White-Mortar Aggregates: Natural white sand or crushed white stone.

4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C 404.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Euclid Chemical Company (The); Accelguard 80.
b. Grace Construction Products, W.R. Grace & Co. – Conn.; Morset.
c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA

I. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized carbon steel.

2. Exterior Walls: Hot-dip galvanized carbon steel.

3. Wire Size for Side Rods: 9-gage diameter.

4. Wire Size for Cross Rods: 9-gage diameter.

5. Wire Size for Veneer Ties: 9-gage diameter.

6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.

7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.

D. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus one side rod at each wythe of masonry 4 inches wide or less.

2. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch cover on outside face.

3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.8 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.9 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying withSMACNA's "Architectural Sheet Metal Manual", Section 07 62 00 "Sheet Metal Flashing and Trim" and as follows:

1. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

2. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

3. Solder metal items at corners.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

        1) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
        2) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
        3) Fiberweb, Clark Hammerbeam Corp.; Aquaflash 500.
        4) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
        5) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
        6) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
        7) Polyguard Products, Inc.; Polyguard 400.
        8) Sandell Manufacturing Co., Inc.; Sando-Seal.
        9) Wire-Bond; Aqua Flash 500.

    b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
4. Where flashing is fully concealed, use flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

F. Termination Bars for Flexible Flashing: Stainless steel bars 1/8 inch by 1 inch with a sealant flange at top.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

D. Weep/Cavity Vent Products: Use the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Advanced Building Products Inc.; Mortar Maze Cell Vent.
2) Heckmann Building Products, Inc.; No. 85 Cell Vent.
3) Hohmann & Barnard, Inc.; QV Quadro-Vent.
4) Wire-Bond; Cell Vent.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products: Subject to compliance with requirements, provide one of the following:
a. CavClear/Archovations, Inc.; CavClear Masonry Mat.
b. Heckmann Building Products, Inc.; Weep-Thru Mortar Deflector.
c. Hohmann & Barnard, Inc.; Mortar Trap.
d. Mortar Net USA, Ltd.; Mortar Net.

2. Configuration: Provide one of the following:

a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.
b. Strips, full-depth of cavity and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
b. EaCo Chem, Inc.
c. PROSOCO, Inc.

2.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

2. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type M.

2. For reinforced masonry, use Type S.

3. For exterior, above-grade, load-bearing masonry walls, use Type S.

4. For exterior, above-grade, veneer and nonload-bearing walls and parapet walls, use Type N.

5. For interior load-bearing walls, use Type N.

6. For interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:
   a. Face brick.
   b. Cast-stone trim units.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.

2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2500 psi.

3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

2. Verify that foundations are within tolerances specified.

3. Verify that reinforcing dowels are properly placed.

4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.

2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.

3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.

2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.

3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.

5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.

2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.

3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.

4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry inrunning bond ; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-In Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

G. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.

3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 43 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.

2. Bed webs in mortar in all courses of piers, columns, and pilasters.

3. Bed webs in mortar in grouted masonry, including starting course on footings.

4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.

2. Wet joint surfaces thoroughly before applying mortar.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

E. Cut joints flush where indicated to receive direct-applied finishes (other than paint) unless otherwise indicated.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 1.77 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

    a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.
    b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) ties to allow for differential movement regardless of whether bed joints align.

2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

    a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
    b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.
    c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.

3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not more than 8 inches clear horizontally and 16 inches clear vertically.

4. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Apply air barrier to face of backup wythe to comply with Section 07 27 26 "Fluid-Applied Membrane Air Barriers."

D. Install cavity wall insulation to comply with Section 07 21 00 “Thermal Insulation.”

3.7 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.

2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.

3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.

2. Install preformed control-joint gaskets designed to fit standard sash block.

3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.

4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

C. Provide horizontal, pressure-relieving joints by inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 LINTELS

A. Install steel lintels where indicated.

B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal

penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.

3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.

4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.

2. Space weep holes 24 inches o.c. unless otherwise indicated.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

2. Limit height of vertical grout pours to not more than 60 inches.

3.12 IDENTIFICATION OF INTERIOR FIRE- AND SMOKE-RATED MASONRY WALLS AND PARTITIONS

A. Markings and Identification: Refer to requirements specified in Section 09 91 23 “Interior Painting.”

3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level C in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.

3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent

construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Protect adjacent stone and nonmasonry surfaces from contact with cleaner.

2. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

3. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.15 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00

SECTION 04 72 00

CAST STONE MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast stone trim.

B. Related Requirements:

1. Section 04 20 00 "Unit Masonry" for installing cast-stone units in unit masonry, including mortar materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For cast-stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

C. Samples:

1. For each color and texture of cast stone required.
2. For colored mortar.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.

1. Provide test reports based on testing within previous two years.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast-stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute or the Architectural Precast Association.

B. Mockups: Furnish cast stone for installation in mockups specified in Section 04 20 00 "Unit Masonry."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.

B. Pack, handle, and ship cast-stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast-stone units if required, using dollies with wood supports.
2. Store cast-stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Cast Stone: Obtain cast-stone units from single source from single manufacturer.

2.2 CAST-STONE MATERIALS

A. General: Comply with ASTM C 1364.

B. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33/C 33M; gradation and colors as needed to produce required cast-stone textures and colors.

C. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33/C 33M, gradation and colors as needed to produce required cast-stone textures and colors.

D. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

E. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C 260/C 260M. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.

4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.

F. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast-stone material.

1. Epoxy Coating: ASTM A 775/A 775M.
2. Galvanized Coating: ASTM A 767/A 767M.

G. Embedded Anchors and Other Inserts: Fabricated from steel complying with ASTM A 36/A 36M and hot-dip galvanized to comply with ASTM A 123/A 123M.

2.3 CAST-STONE UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cast Stone Systems, Inc.
2. Continental Cast Stone East by Russell.
3. Hoyle Stone Products.
4. D. C. Kerckhoff.
5. Reading Rock; RockCast.
6. Sun Precast Company.

B. Regional Materials: Cast-stone units shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

C. Cast-Stone Units: Comply with ASTM C 1364.

1. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

D. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

E. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

F. Cure Units as Follows:

1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

    a. No fewer than five days at mean daily temperature of 70 deg F or above.
    b. No fewer than six days at mean daily temperature of 60 deg F or above.
    c. No fewer than seven days at mean daily temperature of 50 deg F or above.
    d. No fewer than eight days at mean daily temperature of 45 deg F or above.

G. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

H. Colors and Textures: Provide units with fine-grained texture and buff color resembling smooth-finished Indiana limestone.

2.4 MORTAR MATERIALS

A. Provide mortar materials that comply with Section 04 20 00 "Unit Masonry."

2.5 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from steel complying with ASTM A 36/A 36M and hot-dip galvanized to comply with ASTM A 123/A 123M.

B. Dowels: 1/2-inch- diameter round bars, fabricated from steel complying with ASTM A 36/A 36M and hot-dip galvanized to comply with ASTM A 123/A 123M.

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner complying with requirements in Section 04 20 00 “Unit Masonry,” and expressly approved for intended use by cast stone manufacturer and cleaner manufacturer.

2.6 MORTAR MIXES

A. Comply with requirements in Section 04 20 00 "Unit Masonry" for mortar mixes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

A. Install cast-stone units to comply with requirements in Section 04 20 00 "Unit Masonry."

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Set units with joints 1/4 to 3/8 inch wide unless otherwise indicated.
2. Build anchors and ties into mortar joints as units are set.
3. Fill dowel holes and anchor slots with mortar.
4. Fill collar joints solid as units are set.
5. Build concealed flashing into mortar joints as units are set.
6. Keep head joints and contiguous vertical joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
7. Keep joints at shelf angles open to receive sealant.

E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

G. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

H. Provide sealant joints at head joints and contiguous vertical joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Build in compressible foam-plastic joint fillers where indicated.
3. Form joint of width indicated, but not less than 3/8 inch.
4. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 92 00 "Joint Sealants."

3.3 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

A. Set units accurately in locations indicated on Drawings, with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments necessary to secure units in place.
2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.

B. Fill anchor holes with sealant.

1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.

C. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

D. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast-stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.

1. Form open joint of width indicated, but not less than 3/8 inch.

E. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

F. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 92 00 "Joint Sealants."

3.4 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.5 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

END OF SECTION 04 72 00

DIVISION 05 – METALS

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - **GENERAL**

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes structural steel, architecturally exposed structural steel, beams and girders.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.

B. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for structural steel connections.

1.4 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges", that support design loads.

B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents. Exposed canopy framing.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the conditions of the Contract and Division 01 Specification Sections.

B. Product Data: For each type of product**,** including the following:

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.
2. Product Certificates: For products and materials which comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project and fraction by weight that is considered regional. (For information only)

C. Shop Drawings detailing fabrication of structural steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.
5. Submit calculations for connection design with certificate signed by a Maryland professional engineer stating that they have been designed by or under his/her direct supervision.

D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.

1. Structural steel, including chemical and physical properties.
2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Tension-control, high-strength bolt-nut-washer assemblies.
5. Shear stud connectors.
6. Shop primers.
7. Non-shrink grout.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

C. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings."
2. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."
3. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
4. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in Maryland and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."

1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 SEQUENCING

A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All structural steel including wide flange shapes, tubes, pipes, angles, bars, plates, channels, bolts, studs, etc., shall be from stock of domestic origin, and shall meet all of the requirements of the “Maryland Buy American Steel Act.”

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Structural Steel Shapes, Plates, and Bars: As follows:

1. Carbon Steel: ASTM A 36 for plates, bars, angles and C-shapes.
2. Carbon Steel: ASTM A 992, Grade 50, for wide flange shapes and MC-shapes.

D. Steel Pipe: ASTM A 500, Grade B.

E. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B.

F. Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: as indicated on drawings.
2. Nuts: ASTM A 563 heavy hex carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.
4. Finish: Plain.

G. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, ASTM A 563 heavy hex carbon-steel nuts, and ASTM F 436 hardened carbon-steel washers.

H. Threaded Rods: ASTM A 307, Grade A.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Washers: ASTM F 436 hardened carbon steel.
3. Finish: Plain.

I. Welding Electrodes: Comply with AWS requirements.

J. Primer: Lead and chromate-free, non-asphaltic, rust-inhibiting primer for steel not exposed to the weather.

K. Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, shrinkage resistant, mixed with water to consistency suitable for application and a 30-minute working time.

L. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud-type, cold finished carbon steel; AWS D1.1, Type B.

M. Deformed Bar Anchor: Low Carbon Steel. ASTM A 496.

2.2 FABRICATION

A. Structural Steel: Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Identify high-strength structural steel according to ASTM A 6 (ASTM A 6M) and maintain markings until steel has been erected.
2. Mark and match-mark materials for field assembly.
3. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
4. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
5. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

B. Architecturally Exposed Structural Steel: comply with fabrication requirements, including tolerance limits, of AISC's Code of Standard Practice for Steel Buildings and Bridges for structural steel identified as architecturally exposed structural steel.

1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded.

D. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

E. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.

1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.

2.3 SHOP CONNECTIONS

A. Shop install and tighten non-high-strength bolts, except where high-strength bolts are indicated.

B. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.
2. Connection Type: Snug tightened.

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

D. Architecturally Exposed Structural Steel Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work, and comply with the following:

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding specified tolerances..
2. Use weld sizes, fabrication sequence, and equipment for AESS that limit distortions to allowable tolerances.
3. Provide continuous welds of uniform size and profile where AESS is welded.
4. Make butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch for AESS. Do not grind unless required for clearances for fitting other components, or unless directed to correct unacceptable work.
5. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for AESS.
6. At locations where welding on the far side of an exposed connection of AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
7. Make fillet welds for AESS of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to correct unacceptable work.

E. Shop Priming:

1. Prepare surfaces according to SSPC-SP 2 or SSPC-SP 3. Shop prime steel to a dry film of at least 1.5 mils.
2. Do not prime surfaces to be embedded in concrete or mortar, to be filed welded, galvanized, to be high-strength bolted with slip-critical connections, or to receive sprayed-on-fireproofing.

F. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A 123.

1. Structural steel members exposed to the weather.
2. Lintels and shelf angles located in exterior walls.
3. Surface Preparation: SSPC-SP7 “Brush-Off Blast Cleaning.”
4. Galvanizing Repair Paint: ASTM A 780.

2.4 SOURCE QUALITY CONTROL

A. General Contractor shall engage and pay for an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.

1. Structural tests and special inspections to be in accordance with International Building Code, chapter 17.
2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
4. Ultrasonic Inspection: ASTM E 164.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements. Coordinate placement of bearing plates with wall reinforcement.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

a. Comply with manufacturer's instructions for proprietary grout materials.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection unless approved by the Engineer. If approved, finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. Install and tighten non-high-strength bolts, except where high-strength bolts are indicated.

B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.
2. Connection Type: Snug tightened.
3. Joint Type: Slip critical.

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind flush butt welds. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. General Contractor shall engage and pay for an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.

1. Structural tests and special inspections to be in accordance with International Building Code, chapter 17.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
4. Ultrasonic Inspection: ASTM E 164.

3.6 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Clean and prepare surfaces by SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

END OF SECTION 05 12 00

SECTION 05 21 00

STEEL JOISTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Open-web K-series steel joists.
2. KCS-type, open-web K-series steel joists.
3. Joist accessories and bridging.

1.3 DEFINITIONS

A. Special Joists: Joists requiring modification by the manufacturer to support non-uniform, unequal, or special loading conditions that invalidate SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders."

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads within limits and under conditions indicated.

B. Design roof joists to withstand a wind uplift load of 15 p.s.f.

C. Design joists to withstand design loads with total load deflections no greater than the following:

1. Roof Joists: Vertical deflection of 1/240 of the span.

1.5 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product, including the following:

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.
2. Product Certificates: For products and materials which comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project and fraction by weight that is considered regional. (For information only)

B. Shop Drawings: Show layout, mark, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, accessories; splice and connection locations and details; and attachments to other construction.

1. Indicate locations and details of anchorage devices and bearing plates to be embedded in other construction.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Mill certificates signed by manufacturers of bolts certifying that their products comply with specified requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Research/Evaluation Reports: Evidence of steel joists' compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance.

1. Manufacturer must be certified by SJI to manufacture joists complying with SJI standard specifications and load tables.
2. Assumes responsibility for engineering special joists to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
3. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of joists that are similar to those indicated for this Project in material, design, and extent.
4. Steel should be manufactured in the United States.

B. SJI Specifications: Comply with SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders" (hereafter, "Specifications"), applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.3 "Structural Welding Code--Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

A. Deliver steel bearing plates and other devices to be built into concrete and masonry construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All steel including joist chord and web members, plates, bolts, etc., shall be from stock of domestic origin, and shall meet all of the requirements of the “Maryland Buy American Steel Act.”

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel: Comply with SJI's "Specifications" for chord and web members.

D. Steel Bearing Plates: ASTM A 36/A 36M.

E. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

F. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

A. Primer: SSPC-Paint 15, Type I, red oxide; FS TT-P-636, red oxide; or manufacturer's standard shop primer complying with performance requirements of either of these red-oxide primers.

2.3 OPEN-WEB K-SERIES STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord; of joist type indicated.

1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

E. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span.

1. Furnish additional erection bridging if required.
2. Furnish additional bridging if required by uplift loading.

B. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories to be primed by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Apply one shop coat of primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1.5 mil (0.038 mm) thick.

PART 3 - **EXECUTION**

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.

3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: General Contractor will engage a qualified independent testing and inspecting agency to inspect field welds.

B. Field welds will be visually inspected according to AWS D1.1.

C. Correct deficiencies in Work that inspections and test reports have indicated are not in compliance with specified requirements.

D. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories and abutting structural steel.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 21 00

SECTION 05 31 00

STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck.
2. Composite steel floor deck.
3. Non-composite form deck.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated**,** including the following:

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.
2. Product Certificates: For products and materials which comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project and fraction by weight that is considered regional. (For information only)

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Research/Evaluation Reports: Evidence of steel deck's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

F. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:

1. Acoustical roof deck.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

D. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

E. FM Listing: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.6 COORDINATION

A. Coordinate layout and installation of trench headers, preset inserts, duct fittings, and other components.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All steel deck shall be from stock of domestic origin, and shall meet all of the requirements of the “Maryland Buy American Steel Act.”

B. Recycled Content of Steel Deck Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Steel Deck:

a. Consolidated Systems, Inc.
b. Nucor Corp.; Vulcraft Div.
c. Roof Deck, Inc.
d. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp.

B. All steel should be produced in the United States of America.

2.3 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 29, and the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 G60 zinc coating.
2. Deck profile: Type WR, wide rib.
3. Profile depth: 1-1/2 inches.
4. Design uncoated-steel thickness: 0.0295 inch.

2.4 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 29, the minimum section properties indicated, and the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Profile Depth: 3 inches.
3. Design Uncoated-Steel Thickness: 0.0474 inch.
4. Span Condition: Double span, minimum.

2.5 NON-COMPOSITE FORM DECK

A. Non-composite Steel Form Deck: Fabricate ribbed-steel sheet non-composite form deck panels to comply with "SDI Specifications and Commentary for Non-composite Steel Form Deck," in SDI Publication No. 29, the minimum section properties indicated, and the following:

1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33 ksi, G60 zinc coating. Hot dip galvanize according to A924.
2. Profile Depth: 1 inch.
3. Design Uncoated-Steel Thickness: 0.0295 inch.
4. Span Condition: Triple span or more.
5. Side Laps: Interlocking seam.

2.6 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8 mm) minimum diameter.

C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

E. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

F. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and recessed pans of 1-1/2- inch (38-mm) minimum depth. For drains, cut holes in the field.

G. Galvanizing Repair Paint: ASTM A 780 SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch (1.52 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.

B. Locate decking bundles to prevent overloading of supporting members.

C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.

F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.

G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF DECK INSTALLATION

A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated as follows:

1. Weld Diameter: 5/8 inch (15.8 mm), nominal.
2. Typical Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches (305 mm) apart in the field of the roof and 6 inches (150 mm) apart in roof corners and perimeter, defined as a 12’–0” wide strip measured from the inside face of exterior wall.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches (910 mm), and as follows:

1. Mechanically fasten with self-drilling No. 10 (4.8-mm-) diameter or larger carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least 1 weld at each corner.

E. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR DECK INSTALLATION

A. Fasten floor deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch (16 mm).
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart.
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches (910 mm), and as follows:

1. Mechanically fasten with self-drilling No. 10 (4.8-mm-) diameter or larger carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Butted.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

E. Floor Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of decking. Weld cover plates at changes in direction of floor deck panels, unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: General Contractor shall engage and pay for a qualified independent testing agency approved by the Architect to perform field quality-control testing.

B. Field welds will be subject to inspection.

C. Shear connector stud welds will be inspected and tested according to AWS D1.1 for stud welding and as follows:

1. Shear connector stud welds will be visually inspected.
2. Bend tests will be performed if visual inspections reveal less than a full 360-degree flash or welding repairs to any shear connector stud.
3. Tests will be conducted on additional shear connector studs if weld fracture occurs on shear connector studs already tested according to AWS D1.1.

D. Testing agency will report test results promptly and in writing to Contractor, Architect, and Engineer.

E. Remove and replace work that does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior curtain-wall framing.

B. Related Sections include the following:

1. Division 09 Section "Non-Load Bearing Steel Framing" for interior non-load-bearing, metal-stud framing.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As required by local codes and authorities having jurisdiction.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

a. Exterior Curtain-Wall Framing: Horizontal deflection of 1/360 of the wall height.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
2. Design exterior curtain-wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory, including the following:

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.
2. Product Certificates: For products and materials which comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project and fraction by weight that is considered regional. (For information only)

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For professional engineer.

E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state of Maryland and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

E. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction

G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

H. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All steel sheet shall be from stock of domestic origin, and shall meet all of the requirements of the “Maryland Buy American Steel Act.”

B. Recycled Content of Steel Sheet Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G60 or equivalent zinc alloy coating.

2.2 EXTERIOR CURTAIN-WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As required by structural performance.
2. Flange Width: Not less than 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.3 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. Stud kickers, knee braces, and girts.
6. Backer plates.

2.4 ANCHORS, CLIPS, AND FASTENERS

A. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

B. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

C. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

D. Welding Electrodes: Comply with AWS standards.

2.5 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track members.

2.6 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install sealer gaskets to isolate the underside of wall bottom track and the top of slab or foundation.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 07 Section "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR CURTAIN-WALL FRAMING INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: Not more than 16 inches.

C. Set studs plumb, except as needed for diagonal bracing.

D. Isolate curtain-wall steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

A. Testing: General Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for countertops.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Elevator machine beams and hoist beams.
6. Steel shapes for supporting elevator door sills.
7. Shelf angles.
8. Metal ladders including elevator pit ladders.
9. Elevator pit sump covers.
10. Metal downspout boots.
11. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 05 12 00 "Structural Steel Framing."
4. Section 05 52 13 “Pipe and Tube Railings.”
5. Section 12 93 00 "Site Furnishings" for bicycle racks.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
1. Paint products.
2. Grout.
3. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.

B. Shop Drawings: Show fabrication and installation details. Include details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for countertops.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Elevator machine beams and hoist beams.
6. Steel shapes for supporting elevator door sills.
7. Shelf angles.
8. Metal ladders including elevator pit ladders.
9. Elevator pit sump covers.
10. Metal downspout boots.
11. Loose steel lintels.

C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer as defined in Section 01 40 00 “Quality Requirements” who is responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design ladders.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

F. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

G. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches unless otherwise indicated.
2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; 0.079-inch, 14-gage nominal thickness.
3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0677-inch, 14-gage minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.

H. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

H. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 Interior Painting."

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where exposed to exterior, where installed in exterior construction, or where indicated.

E. Prime interior miscellaneous framing and supports where to remain exposed.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

2.8 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:

1. Space siderails 16 inches apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch- diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch in least dimension.
7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
8. Galvanize and prime exterior ladders, including brackets.
9. Prime interior ladders, including brackets and fasteners.

2.9 ELEVATOR PIT SUMP COVERS

A. Fabricate from 1/8-inch rolled-steel floor plate with four 1-inch- diameter holes for water drainage and for lifting.

B. Provide steel angle supports as indicated.

2.10 METAL DOWNSPOUT BOOTS

A. Provide downspout boots made from cast iron in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.

B. Prime cast-iron downspout boots with primer specified in Section 09 91 13 "Exterior Painting."

2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates located in exterior construction and where indicated.

C. Prime interior loose bearing and leveling plates where to remain exposed.

2.12 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior wall construction.

D. Galvanize and prime loose steel lintels located in exterior wall construction where to remain exposed.

E. Prime interior loose steel lintels where to remain exposed

2.13 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.14 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
2. Galvanize miscellaneous metal fabrications specified in this Section where exposed to exterior or embedded in exterior roof or wall construction unless otherwise indicated.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Other Items: SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to, and rigidly brace from, building structure.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 50 00

SECTION 05 51 13

METAL PAN STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Section 05 52 13 "Pipe and Tube Railings" for pipe and tube railings not attached to metal stairs or to walls adjacent to metal stairs.
3. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood blocking for anchoring railings.
4. Section 09 22 16 "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

1.4 ACTION SUBMITTALS

A. Product Data: For metal pan stairs and the following:
1. Paint products.
2. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type and finish of nosing.

D. Delegated-Design Submittal: For stairs and railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design stairs and railings.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Steel Tubing: ASTM A 500 (cold formed).

E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

F. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.

G. Woven-Wire Mesh: Intermediate-crimp, square pattern, 2-inch woven-wire mesh, made from 0.135-inch nominal diameter wire complying with ASTM A 510.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

2.5 PRECAST CONCRETE TREADS

A. Concrete Materials and Properties: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 5000 psi and a total air content of not less than 4 percent or more than 6 percent.

B. Reinforcement: Galvanized, welded wire reinforcement, 2 by 2 inches by 0.062-inch- diameter wire; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.

2.6 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.7 STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of steel plates or channels.

    a. Provide closures for exposed ends of channel stringers.

2. Construct platforms of steel channelheaders and miscellaneous framing members as needed to comply with performance requirements.
3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch, 14-gage.

1. Steel Sheet: Uncoated cold-rolled steel sheet unless otherwise indicated.

2. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
3. Provide subplatforms of configuration indicated on Drawings or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.8 STAIR RAILINGS

A. Comply with applicable requirements in Section 05 52 13 "Pipe and Tube Railings."

1. Fabricate newels of square steel tubing and provide newel caps of pressed steel, as shown.
2. Rails may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.
3. Connect posts to stair framing by direct welding unless otherwise indicated.

B. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: 1-1/2-inch- square top and bottom rails and 1-1/2-inch- square posts.
2. Picket Infill: 1/2-inch- round pickets spaced less than 4 inches clear.
3. Gates: Form gates from steel tube of same size and shape as top rails, with infill to match guards. Provide with cam-type, self-closing hinges for fastening to wall and overlapping stop with rubber bumper to prevent gate from opening in direction opposite egress.

C. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed as shown in NAAMM AMP 521.

D. Form changes in direction of railings by bending.

E. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

F. Close exposed ends of railing members with prefabricated end fittings.

G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

H. Connect posts to stair framing by direct welding unless otherwise indicated.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.

2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

2.9 FINISHES

A. Finish metal stairs after assembly.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLING METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms to comply with Section 03 30 00 "Cast-in-Place Concrete."

3.2 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts to steel by welding to steel supporting members.

2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements and as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 05 51 13

SECTION 05 52 13

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes interior and exterior steel pipe and tube railings.

B. Related Requirements:

1. Section 05 51 12 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.
4. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required and for fittings and brackets.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

D. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide 1-1/4 inch (1.6 inch OD) steel pipe railings unless otherwise indicated.
2. Provide galvanized finish for exterior installations and where indicated.

D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

1. Metal Fittings for Steel Pipe Railings:

a. Basis-of-Design Products: Subject to compliance with requirements, provide the following products or comparable product:

1) Wall Brackets: Blum, Julius & Co., Inc.; Model #386, malleable iron.
2) End Flanges: Blum, Julius & Co., Inc.; Model #911, pressed steel.
3) End Caps: Blum, Julius & Co., Inc.; Model #938, steel, flush with hemispherical end and integral alignment sleeves.
4) Expansion Bolts: Metal shield type including washers.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI #25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

E. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.

F. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form changes in direction by bending or by inserting prefabricated elbow fittings.

K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.7 STEEL FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:

1. Exterior Railings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Other Railings: SSPC-SP 3, "Power Tool Cleaning."

F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.3 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

3.4 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends or connected to railing ends using nonwelded connections.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

C. Attach railings to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop, make required alterations, and refinish entire unit, or provide new units.

END OF SECTION 05 52 13

DIVISION 06 – WOODS, PLASTICS, AND COMPOSITES

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Rooftop equipment bases and support curbs.
2. Wood blocking and nailers.
3. Wood furring.
4. Plywood backing panels.

B. Related Requirements:

1. Section 06 16 00 "Sheathing" for sheathing and subflooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated materials.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
6. For adhesives used on the interior of the building, include a statement of VOC content in g/L.

1.4 INFORMATIONAL SUBMITTALS

A. Chain-of-Custody Certificates: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body.

B. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Certified Wood: Wood-based materials and products shall be certified as "FSC Pure" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated or where required by code, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated on Drawings.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

E. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

F. Application: Treat items indicated on Drawings, and the following:

1. Concealed blocking.
2. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
3. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated on Drawings and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Furring.

B. Concealed Boards: 19 percent maximum moisture content of any of the following species and grades:

1. Mixed southern pine or southern pine, No. 3 grade; SPIB.
2. Eastern softwoods, No. 3 Common grade; NELMA.
3. Northern species, No. 3 Common grade; NLGA.
4. Western woods, Standard or No. 3 Common grade; WCLIB or WWPA.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated on Drawings that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Screws for Fastening to Metal Framing: ASTM C 1002 for "drywall-type" non-load-bearing steel framing, ASTM C 954 for cold-formed metal framing, length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308, as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

1. Multipurpose construction adhesives used on the interior of the building (i.e. inside the weatherproofing system and applied on-site) must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168, effective date of July 1, 2005, and rule amendment date of January 7, 2005, and shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Flashing: Self-adhesive rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Do not splice structural members between supports unless otherwise indicated.

E. Provide blocking and framing as indicated on Drawings and as required to support facing materials, fixtures, specialty items, and trim.

F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated on Drawings and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

I. Where wood-preservative-treated lumber is installed adjacent to steel, including galvanized steel, install continuous flexible flashing separator between wood and steel.

J. Securely attach carpentry work to substrate by anchoring and fastening as indicated on Drawings, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated on Drawings and where required for attaching other work. Form to shapes indicated on Drawings and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading with bolts at 24-inch centers unless otherwise indicated on Drawings. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood Paneling: Install 1-by-3-inch nominal- size furring vertically at 24 inches o.c.

3.4 PROTECTION

A. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53

SECTION 06 16 00

SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Parapet sheathing.
3. Subflooring.
4. Sheathing joint and penetration treatment.

B. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for plywood backing panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 INFORMATIONAL SUBMITTALS

A. Chain-of-Custody Certificates: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Foam-plastic sheathing.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

A. Certified Wood: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

1. Plywood.

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/D 3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings, or where required by code.

2.4 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. CertainTeed Corporation; GlasRoc.
   b. Georgia-Pacific Building Products; Dens-Glass Gold
   c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
   d. United States Gypsum Company; Securock.

2. Type and Thickness: Type X, 5/8 inch thick.

2.5 PARAPET SHEATHING

A. Plywood Sheathing: DOC PS 1, Exterior sheathing.

1. Span Rating: Not less than 24/0.
2. Nominal Thickness: Not less than 1/2 inch.

2.6 SUBFLOORING

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exterior, Structural I, C-C Plugged single-floor panels.

1. Span Rating: Not less than 16.
2. Nominal Thickness: Not less than 5/8 inch.
3. Edge Detail: Tongue and groove.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For walland parapet sheathing, provide stainless steel fasteners.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

E. Screws for Fastening Glass-Mat Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch, 20-gage, thick, use screws that comply with ASTM C 1002.
2. For steel framing from 0.033 inch, 20-gage, to 0.112 inch, 11-gage, thick, use screws that comply with ASTM C 954.

2.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Parapet Sheathing: Screw to cold-formed metal framing.

2. Subflooring: Nail to wood framing.

3.3 GLASS-MAT GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten glass-mat gypsum sheathing to cold-formed metal framing with screws.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

D. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.

END OF SECTION 06 16 00

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 07 16 13

MODIFIED CEMENT WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes polymer-modified cement waterproofing for negative-side application to concrete or concrete unit masonry at elevator pits

B. Related Sections:

1. Section 03 30 00 "Cast-In-Place Concrete" for waterstops , concrete slabs serving as floor toppings to protect waterproofing, and finishing concrete walls and slabs to receive waterproofing.
2. Section 04 20 00 "Unit Masonry" for construction cleaning of unit masonry walls to receive waterproofing.
3. Section 07 92 00 "Joint Sealants" for elastomeric and preformed sealants in concrete and masonry walls and floors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions and installation instructions for polymer-modified cement waterproofing.

1. For coatings, include VOC content in g/L.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for each type of polymer-modified cement waterproofing.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying polymer-modified cement waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and that employs workers trained and approved by manufacturer.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit polymer-modified cement waterproofing to be performed according to manufacturer's written instructions.

B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.

C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F or above during work and cure period, and space is well ventilated and kept free of water.

PART 2 - PRODUCTS

2.1 PREPACKAGED, POLYMER-MODIFIED CEMENT WATERPROOFING

A. Negative-Side, Polymer-Modified Cement Waterproofing: Manufacturer's proprietary blend of dry cementitious and other ingredients for mixing with potable water or polymer admixture to produce a waterproof coating that is suitable for vertical and horizontal applications below or above grade, is breathable, resists negative-side hydrostatic pressure, has VOC content complying with limits of authorities having jurisdiction, and has properties meeting or exceeding the criteria specified below.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. BASF Corporation; Thoroseal.
   b. Euclid Tamms; TAMOSEAL.
   c. Sika Corporation, Inc.; Sika Top Seal 107.

2. Water Permeability: Maximum zero for water at 30 feet when tested according to CE CRD-C 48.
3. Compressive Strength: Minimum 4000 psi at 28 days when tested according to ASTM C 109/C 109M.
4. Flexural Strength: Minimum 710 psi at 28 days when tested according to ASTM C 348.
5. Bond Strength: Minimum 220 psi at 14 days when tested according to ASTM C 321.
6. Color: As selected by Architect from full range.
7. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction, but not exceed 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 ACCESSORY MATERIALS

A. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections; compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.

B. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead, and horizontal surfaces not exposed

to vehicular traffic); compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.

C. Portland Cement: ASTM C 150, Type I.

D. Slurry-Coat Sand: ASTM C 144.

E. Trowel-Coat Sand: ASTM C 33, fine aggregate.

F. Polymer Admixture for Protective Topping: Polymer bonding agent and admixture designed to improve adhesion to prepared substrates and to not create a vapor barrier.

G. Water: Potable.

2.3 MIXES

A. Prepackaged, Polymer-Modified Cement Waterproofing: Add prepackaged dry ingredients to mixing liquid according to manufacturer's written instructions. Mix together with mechanical mixer or by hand to required consistency.

B. Protective Topping: Measure, batch, and mix portland cement and sand in the proportion of 1:3 and water gaged with a polymer admixture. Blend together with mechanical mixer to required consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.

B. Proceed with application only after unsatisfactory conditions have been corrected.

C. Notify Architect in writing of active leaks or defects that would affect system performance.

3.2 PREPARATION

A. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to ensure adequate ambient temperatures and ventilation conditions for application.

B. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.

C. Stop active water leaks with plugging compound according to waterproofing manufacturer's written instructions.

D. Repair damaged or unsatisfactory substrate with patching compound according to manufacturer's written instructions.

1. At holes and cracks in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and approximately 1 inch deep. Fill reveal with patching compound flush with surface.

E. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.

1. Clean concrete surfaces according to ASTM D 4258.

a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.

2. Clean concrete unit masonry surfaces according to ASTM D 4261.

a. Medium- and Normal-Weight Concrete Unit Masonry: Sandblast or bushhammer to a depth of 1/16 inch.

3. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

3.3 APPLICATION

A. General: Comply with waterproofing manufacturer's written instructions for application and curing.

1. Saturate surface with water and maintain damp condition until applying waterproofing. Remove standing water.
2. Apply waterproofing to surfaces indicated.
3. Number of Coats: Two.

a. Coating Thickness: Maximum application thickness of 47 mils per coat for total thickness of 100 mils.
b. Apply first coat as a slurry with brush or roller, and apply subsequent coats with brush, roller, spray, or trowel.
c. Vigorously work first coat onto the substrate, forcing the material into surface voids. Apply each subsequent coat into full contact with previous coat.
d. Allow manufacturer's recommended time between coats. Dampen surface between coats.

B. Final Coat Finish: Brushed.

C. Curing: Moist-cure waterproofing for not less than three days immediately after application has set, followed by air drying prior to being placed in service unless otherwise recommended in writing by manufacturer.

D. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:

1. Onto every substrate in areas indicated for treatment, including pits, sumps, and similar offsets and features.

E. Protective Floor Topping: Apply 1-inch- thick, protective topping over floor surfaces.

3.4 FIELD QUALITY CONTROL

A. Inspection: Contractor will engage manufacturer's representative to inspect completed application and provide a written report that application complies with manufacturer's written instructions.

END OF SECTION 07 16 13

SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Insulation fasteners.
3. Glass-fiber and spray polyurethane foam insulation for miscellaneous voids.

B. Related Requirements:

1. Section 04 20 00 "Unit Masonry" for installation of cavity wall insulation.
2. Section 06 16 00 "Sheathing" for foam-plastic board sheathing installed directly over wood or steel framing.
3. Section 07 54 23 "Thermoplastic Polyolefin (TPO) Roofing" for insulation specified as part of roofing construction.
4. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.

2. For adhesives used on the interior of the building, include a statement of VOC content in g/L.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: Low-emitting product certification for glass-fiber insulation products.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded Polystyrene Board: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); Styrofoam Square Edge Extruded Polystyrene Insulation.
b. Owens Corning; Foamular 250 Extruded Polystyrene (XPS) Rigid Foam Insulation.
c. Pactiv Corporation; GreenGuard Type IV 25 PSI Insulation Board.

2.2 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Products: Subject to compliance with requirements, provide one of the following:

a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
b. Gemco; Spindle Type.

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Products: Subject to compliance with requirements, provide the following provide one of the following:

a. Gemco; 90-Degree Insulation Hangers.

2. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

1. Products: Subject to compliance with requirements, provide one of the following:

a. AGM Industries, Inc.; RC150.
b. Gemco; R-150.

2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
a. Ceiling plenums.
b. Where indicated.

D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

a. AGM Industries, Inc.; TACTOO Adhesive.
b. Gemco; Tuff Bond Hanger Adhesive.

2.3 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

1. Multipurpose construction adhesive used on the interior of the building[(defined as inside the weatherproofing system and applied on-site) shall comply with South Coast Air Quality Management District (SCAQMD) Rule #1168, effective date of July 1, 2005, and rule amendment date of January 7, 2005, and] shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value indicated on Drawings.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 20 00 "Unit Masonry."

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 27 26

FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fluid-applied, vapor-retarding membrane air barriers.

B. Related Requirements:

1. Section 06 16 00 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.3 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
2. For air-barrier products, include a statement of VOC content in g/L.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
2. Include details of interfaces with other materials that form part of air barrier.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Laboratory Test Reports: For air barriers, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assemblyas shown on Drawings, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
    a. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

B. VOC Content: Air barrier materials shall not exceed the VOC content limits established in Green Seal Standard GS-11, Paints, First Edition, May 20, 1993, and] shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and complying with VOC content limits of authorities having jurisdiction.

2.2 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E 283 or ASTM E 783 or ASTM E 2357 .

2.3 VAPOR-RETARDING MEMBRANE AIR BARRIER

A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric, modified bituminous or synthetic polymer membrane.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Henry Air-Bloc 32MR or comparable product by one of the following:

a. Carlisle Coatings & Waterproofing Inc.
b. W.R. Meadows, Inc.

2. Physical and Performance Properties:

a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
b. Vapor Permeance: Maximum 0.1 perm; ASTM E 96/E 96M.
c. Ultimate Elongation: Minimum 500 percent; ASTM D 412, Die C.

2.4 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.

B. Primer: Low VOC, liquid primer recommended for substrate by air-barrier material manufacturer.

C. Counterflashing Strip: Modified bituminous, 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, cross-laminated polyethylene film with release liner backing.

D. Butyl Strip: Vapor retarding, 30 to 40 mils thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.

E. Modified Bituminous Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

F. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.

G. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

H. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

I. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

J. Modified Bituminous Transition Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Henry Company; Blueskin SA or comparable product acceptable to air barrier manufacturer.

K. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 123 Silicone Seal.
b. GE Construction Sealants; Momentive Performance Materials Inc.; US11000 UltraSpan.
c. Pecora Corporation; Sil-Span.
d. Tremco Incorporated; Spectrem Simple Seal.

L. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone or silyl-terminated polyether (STPE); Class 35, Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O, acceptable to air barrier membrane manufacturer. Comply with Section 07 92 00 "Joint Sealants."

1. Basis-of-Design Product: Subject to compliance with requirements, provide Henry Company; HE925 BES Sealant or comparable product acceptable to air barrier manufacturer.

M. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.

1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.

B. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

3.4 TRANSITION STRIP INSTALLATION

A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install strip acceptable to both air barrier and roofing membrane manufacturers on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip, adhesive-coated transition strip, or preformed silicone-sealant extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion at sills of wall openings.
2. Adhesive-Coated Transition Strip: Roll firmly to enhance adhesion at heads and jambs of wall openings.
3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

I. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, modified bituminous counterflashing strip.

J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.

1. Apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.

1. Vapor-Retarding Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil dry film thickness, applied in one or more equal coats.

C. Apply strip and transition strip a minimum of 1 inch onto cured air-barrier material or strip and transition strip over cured air-barrier material overlapping 3 inches onto each surface according to air-barrier manufacturer's written instructions.

D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of air-barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed, if applicable.
7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Strips and transition strips have been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Owner reserves the right to have air barriers tested as recommended by Owner's testing and inspection agency, including qualitative air-leakage testing per ASTM E 1186, Methods 4.2.6 and 4.2.7, quantitative air-leakage testing per ASTM E 783, and adhesion testing per ASTM D 4541, if inspection agency reports any deficiencies of the materials and installation.

D. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.7 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 07 27 26

SECTION 07 41 10

MANUFACTURED LINEAR SOFFIT PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Exposed fastener metal wall panels as part of the assembly described below.
   1. Manufactured metal soffit panels, clips, and flashing.
   2. Accessories, sealants, tapes, closures, and metal trim.

B. Related Sections:

1.3 DEFINITIONS

A. Cradle to Cradle Certification: The Cradle to Cradle Certification process, administered by McDonough Braungart Design Chemistry (MBDC), www.c2ccertified.com, that evaluates materials and product ingredients and the complete formulation for human and environmental health impacts throughout its lifecycle as well as its potential for being truly recycled or safely composted.

1.4 REFERENCES

A. American Architectural Manufacturer's Association (AAMA):
   1. AAMA 620 - Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum Substrates.
   2. AAMA 621 - Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.

B. American Society of Civil Engineers (ASCE):
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International (ASTM):
   1. ASTM A 653/A 653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A 755/A 755M - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   3. ASTM B 209 - Specification for Aluminum and Aluminum Alloy Sheet and Plate.
   4. ASTM C 754 - Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products.
   5. ASTM C 920 - Specification for Elastomeric Joint Sealants.

6. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
7. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
8. ASTM E 283 - Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
9. ASTM E 331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

D. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA):
1. Architectural Sheet Metal Manual.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide metal wall panel assemblies meeting performance requirements as determined by application of specified tests by a qualified testing agency on manufacturer's standard assemblies.

B. Wind Loads: ASTM E 330 at 35 pounds/sq. ft., positive and negative; maximum deflection L/240. Specifically wind up-lift under canopy.

C. Air Infiltration: Maximum Air Infiltration: ASTM E 1648, not more than 0.016 CFM/sq.ft. at 12 psf static pressure.

D. Water Infiltration: ASTM E 1680, no leakage at test pressure of 12 psf for 15 minutes.

E. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction.

F. Wall systems that incorporate foam plastic insulation must be tested by the foam plastic supplier in accordance with NFPA-285.

1.6 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal panel and panel accessories from a single manufacturer.

B. Installer Qualifications: Experienced Installer with minimum of 5 years experience with successfully completed projects of a similar nature and scope.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Samples: For each type of exposed finish required.

1. Metal Panels: 12 inches long by 12 inches wide. Include fasteners, closures, and other metal panel accessories.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and professional engineer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.9 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.11 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.12 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.13 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components of metal panel system that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain manufactured linear soffit panel and trim accessories from single manufacturer.

2.2 EXPOSED FASTENER LINEAR SOFFIT PANELS

A. General: Provide factory-formed exposed fastener panels with interconnecting side joints, fastened to supports with exposed fasteners, with factory-applied sealant in side laps when required to meet performance requirements.

1. Basis-of-Design Product: Subject to compliance with requirements, provide CENTRIA Architectural Systems; Econolap 3/4 inch profile, or comparable product by one of the following:

a. Berridge Manufacturing Company.
b. Fabral.
c. Metal-Fab Manufacturing, LLC.
d. Petersen Aluminum Corporation.

B. Panel Coverage: 34.66 inches (880 mm).

C. Panel Height: 0.75 inches (19 mm).

D. Corrugation Spacing: 2.66 inches (68 mm) o.c.

E. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Exterior Finish: Fluoropolymer (PVDF) containing 70% Kynar 500 / Hylar 500 Resins
2. Color: As selected by architect from manufacturer’s full range.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
   1. Hat Channels: 0.053 inch (16 ga.) minimum.
   2. Sill Channels: 0.053 inch (16 ga.) minimum.

2.4 METAL WALL PANEL ACCESSORIES

A. Extruded Trim: Manufacturer's complementary aluminum extrusions for head, jamb, sill, base, flush, reveal, inside and outside corner, end wall, and expansion joint details. Finish matching metal wall panels.

   1. Basis of Design: CENTRIA, Microline Extrusions.

B. Mitered Corners: Structurally-bonded horizontal interior and exterior trimless corners matching metal wall panel material, profile, and factory-applied finish, fabricated and finished by metal wall panel manufacturer.

   1. Welded, riveted, fastened, or field- fabricated corners do not meet the requirements of this specification.
   2. Basis of Design: CENTRIA, MicroSeam Corners.

C. Formed Flashing and Trim: Match material, thickness, and color of metal wall panel face sheets.

D. Sealants: Type recommended by metal wall panel manufacturer for application, meeting requirements of Division 07 Section "Joint Sealants."

E. Flashing Tape: 4-inch wide self-adhering butyl flashing tape.

F. Fasteners: Self-tapping screws, bolts, nuts, and other acceptable fasteners recommended by panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal wall panels by means factory-applied coating.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:
1. Metallic Fluoropolymer: AAMA 620. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels piping to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

B. Fasteners:
1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal plate wall panel units within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

B. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 10

SECTION 07 42 13.13

FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exposed-fastener, lap-seam metal wall panels.

B. Related Requirements:

1. Section 07 42 13.23 "Metal Composite Material Wall Panels" for metal-faced composite wall panels.
2. Section 07 42 13.53 "Metal Soffit Panels" for metal panels used in horizontal soffit applications.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
2. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated.

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.

E. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft.

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Corrugated-Profile, Exposed-Fastener Metal Wall Panels: Formed with alternating curved ribs spaced at 2.67 inches o.c. across width of panel.

1. Basis-of-Design Product: Subject to compliance with requirements, provide CENTRIA Architectural Systems; Econolap 3/4" Metal Panels or comparable product by one of the following:

   a. Berridge Manufacturing Company.
   b. Fabral.
   c. Metal-Fab Manufacturing, LLC.
   d. Petersen Aluminum Corporation.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

   a. Nominal Thickness: 0.040 inch, 20-gage.
   b. Exterior Finish: Two-coat fluoropolymer (PVDF) containing 70% Kynar 500 / Hylar 500 Resins.
   c. Color: As selected by Architect from manufacturer's full range.

3. Rib Spacing: 2.67 inches o.c.
4. Panel Coverage: 34.6 inches.
5. Panel Depth: 3/4 inch.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or

premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
2. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners

where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to perform field tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

C. Metal wall panels will be considered defective if they do not pass tests and inspections.

D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13.13

SECTION 07 42 13.23

METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes engineered metal composite material wall panel system.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal composite material panel indicated.

D. Delegated-Design Submittal: For metal composite material wall panel system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and professional engineer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Manufacturer’s written installation instructions.

D. Field quality-control reports.

E. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer with a minimum of 5 years' experience with the successful installation of metal composite material wall panel systems similar in scope to the work indicated in the Contract Documents.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.

B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal composite material panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design metal composite material wall panel system.

B. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/175 of the span.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft.

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METAL COMPOSITE MATERIAL WALL PANELS

A. Metal Composite Material Wall Panel Systems: Provide an engineered, factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Alcoa Architectural Products (USA); Reynobond PE.
    b. ALUCOBOND; 3A Composites USA, Inc.; Alucobond.
    c. CENTRIA Architectural Systems; Formabond Wall System.

B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- thick, coil-coated aluminum sheet facings.

1. Panel Thickness: 4 mm (0.157 inch), nominal.
2. Core: Standard.
3. Exterior Finish: Two-coat fluoropolymer.

a. Color: As selected by Architect from manufacturer's full range.

C. Attachment Assembly Components: Formed from extruded aluminum.

D. Attachment Assembly: Rout and return dry seal system.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

2.4 FABRICATION

A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.

    a. Verify that air barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal composite material panels.
2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal composite material panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.

D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.

1. Dry Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gasket system.

2. Install wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
3. Do not apply sealants to joints unless otherwise indicated.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to perform field tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal composite material wall panel installation, including accessories.

1. Submit written report.
2. Correct deficiencies noted in report.

C. Metal composite material wall panels will be considered defective if they do not pass inspections.

D. Additional inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished

surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.

B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13.23

SECTION 07 54 23

THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Roof insulation.
3. Walkways

B. Section includes the installation of insulation strips in ribs of roof deck. Insulation strips are furnished under Section 05 31 00 "Steel Decking."

C. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
4. Section 22 14 13 "Storm Water Piping" for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
2. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
4. Review structural loading limitations of roof deck during and after roofing.
5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.

6. Review governing regulations and requirements for insurance and certificates if applicable.
7. Review temporary protection requirements for roofing system during and after installation.
8. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
4. Crickets and saddles, including width, length, and slopes.
5. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For sheet roofing, of color required.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of compliance with performance requirements.

C. Pre-Installation Notice: Roof Installer to provide Pre-Installation Notice (PIN) indicating that this Project has been reviewed by the roofing manufacturer for warranty eligibility upon successful completion.

D. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

1. For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirement.

E. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

F. Manufacturer’s written installation instructions.

G. Field quality-control reports.

H. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

E. Insulation and weather-sensitive materials stocked on the roof shall be elevated or stored on pallets and covered with tarps.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and other components of roofing system.
2. Warranty Period: Twenty (20) years from date of Substantial Completion with no dollar limit (NDL).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Firestone Building Products; UltraPly Platinum TPO or comparable product by one of the following:

1. Carlisle SynTec Incorporated.
2. Firestone Building Products.

B. Source Limitations: Obtain components including roof insulation for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 151 or ASTM G 155.
2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Solar Reflectance Index: Provide exposed roofing materials having a Solar Reflectance Index (SRI) equal to or greater than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 TPO ROOFING

A. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible TPO sheet.

1. Thickness: 80 mils, nominal.
2. Exposed Face Color: White.

a. Provide TPO sheet with an SRI meeting the minimum requirement as specified in “Performance Requirements” article.

2.4 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 60 mils thick, minimum, of same color as TPO sheet.

C. Bonding Adhesive: Manufacturer's standard low VOC adhesive.

D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.

E. Miscellaneous Accessories: Provide metal termination bars, metal battens, pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 (20 psi), felt or glass-fiber mat facer on both major surfaces.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope 1/4 inch per 12 inches unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Insulation Adhesive: Insulation manufacturer's recommended low VOC adhesive formulated to attach roof insulation to substrate or to another insulation layer.

C. Cover Board: ASTM C 1289, high density polyisocyanurate cover board manufactured using “Zero ODP” pentane blowing agents, 1/2 inch thick.

2.7 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 "Steel Decking."
4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Roof Installer to provide warrantable status notification signage at all points of roof access.

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered and offset from joints of previous layer a minimum of 6 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened and Adhered Insulation and Cover Board: Install each layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
2. Set each subsequent layer of insulation in insulation adhesive, firmly pressing and maintaining insulation in place.
3. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered and offset between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together.

a. Set cover boards in insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 ADHERED ROOFING INSTALLATION

A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

I. Where rooftop equipment is to be installed on top of roofing system membrane, adhere an extra sheet of roofing membrane, walkway products, or other material as recommended by roofing manufacturer.

3.6 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

1. Notify Owner and Architect at least 48 hours in advance of date and time of inspection.

B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.9 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 54 23

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Formed roof-drainage sheet metal fabrications.
2. Formed low-slope roof sheet metal fabrications.
3. Formed equipment support flashing.

B. Related Requirements:

1. Section 04 20 00 “Unit Masonry” for concealed flexible flashings installed in exterior masonry construction.
2. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
3. Division 23 specifications for set-on-type curbs, equipment supports, vents, and other manufactured roof accessory units.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

2. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.

3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of special conditions.
8. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; 2D (dull, cold rolled) finish.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226**/**D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

    a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
    c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
1. Manufactured Hanger Style: Fig 1-34A according to SMACNA's "Architectural Sheet Metal Manual."
2. Fabricate from the following materials:
   a. Aluminum: 0.024 inch thick.

B. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
1. Aluminum: 0.032 inch thick.

C. Splash Pans: Fabricate to dimensions and shape required and from the following materials:
1. Aluminum: 0.040 inch thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long sections. Furnish with 6-inch- wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Joint Style: Overlapped, 4 inches wide.
2. Fabricate from the Following Materials:
   a. Aluminum: 0.050 inch thick.

B. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support

edge of external leg and interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.

1. Coping Profile: Fig 3-4A according to SMACNA's "Architectural Sheet Metal Manual."
2. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate.
3. Fabricate from the Following Materials:
   a. Aluminum: 0.050 inch thick.

C. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Aluminum: 0.040 inch thick.

D. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Aluminum: 0.032 inch thick.

E. Flashing Receivers: Fabricate from the following materials:
1. Aluminum: 0.032 inch thick.

F. Roof-Penetration Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.019 inch, 26-gage thick.

G. Roof-Drain Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.019 inch, 26-gage thick.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.019 inch, 26-gage thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum andstainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder aluminum sheet.
2. Do not use torches for soldering.
3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Downspouts: Join sections with 1-1/2-inch telescoping joints.

1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.
2. Connect downspouts to underground drainage system, unless otherwise directed

C. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement or elastomeric sealant compatible with the substrate.

D. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

E. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper or gutter discharge.

3.5 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.

2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of anchor and washer at 36-inch centers unless otherwise indicated.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

SECTION 07 81 00

Addendum #06

APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes sprayed fire-resistive materials.

1.3 DEFINITIONS

A. SFRM: Sprayed fire-resistive materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. For paints and coatings used on the interior of the building, include a statement of VOC content in g/L.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fireproofing.

B. Evaluation Reports: For fireproofing, from ICC-ES.

C. Manufacturer's written installation instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. VOC Content: Coating products used on the interior of the building (defined as inside the weatherproofing system and applied on-site) shall comply with VOC content limits of authorities having jurisdiction and the following VOC limits:

1. Do not exceed the VOC content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993 and the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Flat Topcoat: 50 g/L.
b. Non-Flat Topcoat: 100 g/L.
c. Primer or Undercoat: 100 g/L.

2. Anticorrosive and Antirust Paints Applied to Interior Ferrous Metal Substrates: Do not exceed the VOC content limit of 250 g/L established in Green Seal Standard GC-03, Anti-Corrosive Paints, Second Edition, January 7, 1997.

E. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. Concealed Sprayed Fire-Resistive Material: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Carboline Company; a subsidiary of RPM International; Southwest Type 5GP.
b. Grace Construction Products; W.R. Grace & Co. – Conn.; Monokote MK-6 or Monokote MK-6/HY.
c. Isolatek International; Cafco 300 or Cafco Blaze-Shield II.

2. Bond Strength: Minimum 150-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.

3. Density: Not less than density specified in the approved fire-resistance design, according to ASTM E 605.
4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.3125 inch.
5. Combustion Characteristics: ASTM E 136.
6. Surface-Burning Characteristics: Flame-spread and smoke-developed indexes of 10 or less according to ASTM E 84.
7. Compressive Strength: Minimum 10 lbf/sq. in. according to ASTM E 761.
8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
11. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
12. Locations: Sprayed fire-resistive materials (SFRM) applied to structural steel beams, columns, bracing, and their connections, where covered by other construction.

B. Exposed SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Carboline Company; a subsidiary of RPM International; Southwest Type 7GP.
    b. Grace Construction Products; W.R. Grace & Co. – Conn.; Monokote Z-106 or Monokote Z-106/HY.
    c. Isolatek International; Cafco 400 or Cafco Blaze-Shield HP.

2. Bond Strength: Minimum 150-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
3. Density: Not less than 22 lb/cu. ft. and as specified in the approved fire-resistance design, according to ASTM E 605.
4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.3125 inch.
5. Combustion Characteristics: ASTM E 136.
6. Surface-Burning Characteristics: Flame-spread and smoke-developed indexes of 10 or less according to ASTM E 84.
7. Compressive Strength: Minimum 51 lbf/sq. in. according to ASTM E 761.
8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
11. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21 or rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273.
13. Finish: As selected by Architect from manufacturer's standard finishes.

    a. Color of Topcoat: As selected by Architect from manufacturer's full range.

14. Locations: Sprayed fire-resistive materials (SFRM) applied to exposed structural steel beams, columns, bracing, their connections, and to steel deck.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:

1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.

1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Verify that concrete work on steel deck is complete before beginning fireproofing work.

C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning fireproofing work.

D. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application. Provide temporary enclosure as required to confine spraying operations, protect the environment, and ensure maintenance of adequate ambient conditions for temperature and ventilation.

B. Clean substrates of substances that could impair bond of fireproofing material, including oil, grease, rolling compounds, incompatible primers, and loose mill scale.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:

1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, is completed.
2. Do not apply fireproofing to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fireproofing.

a. If roof traffic is anticipated after SFRM application is complete, then specified roof walkways must be installed.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

I. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

J. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

K. Cure fireproofing according to fireproofing manufacturer's written instructions.

L. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

M. Finishes: Where indicated, apply fireproofing to produce the following finishes:

1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.
4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC, Subsection 17 05 .13, "Sprayed Fire-Resistant Materials."
2. Test and inspect in accordance with the AWCI “Technical Manual 12-A - Standard Practice for the Testing and Inspection of Field-Applied Sprayed Fire-Resistive Materials; an Annotated Guide,” most current edition.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07 81 00

SECTION 07 84 13

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

B. Related Requirements:

1. Section 07 84 43 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.5 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."
2) Intertek Group in its "Directory of Listed Building Products."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Fire Protection Products.
b. Hilti, Inc.
c. RectorSeal.
d. Specified Technologies, Inc.
e. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

F. VOC Content: Penetration firestopping sealants and sealant primers used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) shall comply with South Coast Air Quality management District (SCAQMD) Rule #1168, Rule #1168, effective date of July 1, 2005, and rule amendment date of January 7, 2005 and with the following limits for VOC content:

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant

additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Refer to Section 09 91 23 “Interior Painting” for requirements for permanent identification of interior fire- and smoke-rated walls and partitions.

3.5 FIELD QUALITY CONTROL

A. Where required by code and authorities having jurisdiction, penetration firestopping shall be tested and inspected according to ASTM E 2174, "On-Site Inspection of Installed Fire Stops." Coordinate with third party inspector.

B. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.

C. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

D. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

SECTION 07 84 43

JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

B. Related Requirements:

1. Section 07 84 13 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
2. Section 09 22 16 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.
3. Section 09 91 23 “Interior Painting” for requirements for permanent identification of interior fire- and smoke-rated walls and partitions.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. For joint firestopping system sealants used on the interior of the building, include a statement of VOC content in g/L.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

C. Manufacturer's written installation instructions.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing joint firestopping systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its joint firestopping system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

C. Notify Owner's testing agency at least seven days in advance of joint firestopping system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."

2) Intertek Group in its "Directory of Listed Building Products."

2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints In or Between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Fire Protection Products.
b. Hilti, Inc.
c. RectorSeal.
d. Specified Technologies. Inc.
e. Tremco, Inc.

2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. 3M Fire Protection Products.
b. Hilti, Inc.
c. RectorSeal.
d. Specified Technologies. Inc.
e. Tremco, Inc.
f. <**Insert manufacturer's name**>.

2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

D. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. 3M Fire Protection Products.
b. Hilti, Inc.
c. RectorSeal.
d. Specified Technologies. Inc.
e. Tremco, Inc.
f. <**Insert manufacturer's name**>.

2. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. VOC Content: Joint firestopping system sealants and sealant primers used on the interior of the building[**(defined as inside of the weatherproofing system and applied on-site)**] shall comply with[**South Coast Air Quality management District (SCAQMD) Rule #1168, Rule #1168, effective date of July 1, 2005, and rule amendment date of January 7, 2005 and with**] the following limits for VOC content:

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

G. Low-Emitting Materials: Joint firestopping system sealants and sealant primers installed in the building interior (defined as inside of the weatherproofing system and applied on-site) must meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

H. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with joint firestopping system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise firestopping rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of joint firestopping system.

C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Where required by code and authorities having jurisdiction, joint firestopping systems shall be tested and inspected according to ASTM E 2393, "On-Site Inspection of Installed Fire-Resistive Joint Systems." Coordinate with third party inspector.

B. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

C. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

D. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

END OF SECTION 07 84 43

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.
6. Joint sealant backing.

B. Related Requirements:

1. Section 07 92 19 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
2. Section 32 13 73 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product, including the following:

1. For sealants and sealant primers used on the interior of the building, include a statement of VOC content in g/L.

B. Samples for Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers’ written installation instructions.

B. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion unless otherwise indicated.
2. Warranty Period for Silicone Sealants: Ten (10) years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with South Coast Air Quality management District (SCAQMD) Rule #1168, effective date of July 1, 2005, and rule amendment date of January 7, 2005 and shall comply with the following:

1. Architectural sealants shall have a VOC content of 250 g/L or less.
2. Sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
3. Sealant primers for porous substrates shall have a VOC content of 775 g/L or less.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 795.
b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS9000 SilPruf NB.
c. May National Associates, Inc.; a subsidiary of Sika Corporation; Bondaflex Sil 295 FPS NB.
d. Pecora Corporation; 864NST.
e. Tremco Incorporated; Spectrem 3.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Corporation-Construction Systems; MasterSeal NP 1 (Pre-2014: Sonolastic NP1).

b. Bostik, Inc.; Chem-Calk 915.
c. Pecora Corporation; Dynatrol I-XL.
d. Polymeric Systems, Inc.; Flexiprene 1000.
e. Sherwin-Williams Company (The): Stampede-1.
f. Tremco Incorporated; Dymonic.

B. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T and NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Corporation-Construction Systems; MasterSeal SL 2 (Pre-2014: Sonolastic SL2).
      b. Bostik, Inc.; Chem-Calk 555-SL.
      c. Pecora Corporation; Dynatrol II SG.
      d. Sherwin-Williams Company (The): Stampede-2SL.
      e. Tremco Incorporated; THC 900/901.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 786-M White.
      b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
      c. May National Associates, Inc.; a subsidiary of Sika Corporation; Bondaflex Sil 100 WF.
      d. Tremco Incorporated; Tremsil 200.

2.5 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Bostik, Inc.; Chem-Calk 300.
      b. Pecora Corporation; BC-158.

2.6 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF, paintable.

   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals - Construction Systems; Sonolac.
      b. Pecora Corporation; AC-20.
      c. Tremco Incorporated; Tremflex 834.

2.7 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Backer Rod Mfg. Inc.
b. BASF Construction Chemicals - Construction Systems.
c. Construction Foam Products; a division of Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type B (bicellular material with a surface skin), or either of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and

approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

1. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

a. Whether sealants filled joint cavities and are free of voids.
b. Whether sealant dimensions and configurations comply with specified requirements.
c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:
   a. Isolation and contraction joints in cast-in-place concrete slabs.

2. Joint Sealant: Urethane, M, P, 25, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
   a. Joints between metal panels.
   b. Perimeter joints around frames of doors, windows, storefront and louvers.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

   a. Control joints in unit masonry.
   b. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

   a. Control joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
   c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex, paintable.

E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:

a. Aluminum thresholds.
b. Sill plates.

2. Joint Sealant: Butyl-rubber based.

END OF SECTION 07 92 00

SECTION 07 92 19

ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes acoustical joint sealants for use in interior sound-rated construction.

B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.3 ACTION SUBMITTALS

A. Product Data: For each acoustical joint sealant, including the following:

1. For sealants and sealant primers used on the interior of the building, include a statement of VOC content in g/L.

B. Acoustical-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by a qualified testing agency.

B. Manufacturer’s written installation instructions.

C. Sample Warranties: For special warranties.

1.5 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.

B. VOC Content of Interior Sealants: Sealants and sealant primers used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with South Coast Air Quality management District (SCAQMD) Rule #1168, effective date of July 1, 2005, and rule amendment date of January 7, 2005 and shall comply with the following:

1. Acoustical sealants and sealant primers shall have a VOC content of 250 g/L or less.

2.2 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Accumetric LLC; BOSS 826 Acoustical Sound Sealant.
b. Pecora Corporation; AC-20 FTR.
c. United States Gypsum Company; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Pecora Corporation; BA-98.
b. Serious Energy Inc.; QuietSeal Pro.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so

sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 19

DIVISION 08 – OPENINGS

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes hollow-metal doors and frames.

B. Related Requirements:
1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.
2. Section 09 91 13 "Exterior Painting".
3. Section 09 91 23 "Interior Painting".

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
2. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.

B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.

1. Manufacturer's published details can be submitted in lieu of Shop Drawings for hollow-metal work.

C. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Pioneer Industries.
2. Republic Doors and Frames.
3. Steelcraft; an Ingersoll-Rand brand.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Standard-Duty Doors and Frames: SDI A250.8, Level 1..

1. Physical Performance: Level C according to SDI A250.4.
2. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.032 inch, 20-gage.
d. Edge Construction: Model 1, Full Flush.
e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:

a. Materials: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch, 18-gage.
b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Face welded unless otherwise indicated.

4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches
c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, 18-gage, with minimum A40 coating.
d. Edge Construction: Model 1, Full Flush.
e. Core: Polystyrene.
f. Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

3. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, 16-gage, with minimum A40 coating.
b. Construction: Face welded.

4. Exposed Finish: Prime.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch, 18-gage, thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch, 18-gage, thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, 18-gage, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

G. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

H. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

J. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

K. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated on Drawings.
2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
3. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
6. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:

1) Two anchors per jamb up to 60 inches high.
2) Three anchors per jamb from 60 to 90 inches high.
3) Four anchors per jamb from 90 to 120 inches high.
4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

c. Compression Type: Not less than two anchors in each frame.
d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites where indicated on Drawings. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch- thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.

B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch, 25-gage, thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated on Drawings. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. In-Place Metal Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
6. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

    a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
    e. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 11 13

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

1. For adhesives and composite wood products used on the interior of the building, include documentation indicating that product contains no added urea formaldehyde resins.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.
7. Fire-protection ratings for fire-rated doors.

C. Samples: For factory-finished doors.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

C. Product Certificates: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project and fraction by weight that is considered regional.

D. Chain-of-Custody Certificates: Certificates indicating that flush wood doors comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body is a certified participant in AWI's Quality Certification Program.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons .

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Graham Wood Doors; ASSA ABLOY Group company.
2. Lambton Doors.
3. Mohawk Flush Doors, Inc.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

B. Regional Materials: Flush wood doors shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

C. Certified Wood: Flush wood doors shall be certified as "FSC Pure" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

D. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain added urea formaldehyde resins.

E. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.
2. Extra Heavy Duty: Classrooms, public toilets, janitor's closets, assembly spaces, exits and where indicated.
3. Standard Duty: Closets (not including janitor's closets) and private toilets and where indicated.

F. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
3. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
5. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

    a. Finish steel edges and astragals to match color of doors.

G. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

H. Particleboard-Core Doors:

1. Particleboard: Straw-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
3. Provide doors with glued-wood-stave cores instead of particleboard cores for doors indicated to receive exit devices.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA faces.
2. Species: Select white maple.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
8. Exposed Vertical and Top Edges: Same species as faces or a compatible species - edge Type A.
9. Core: Particleboard.
10. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted ontop and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Paints and coatings installed in the building interior (defined as inside the weatherproofing system) must meet the testing and product requirements of the California Department of Health’s "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Transparent Finish:

1. Grade: Premium.
2. Finish: WDMA TR-6 catalyzed polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Open-grain finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

a. Comply with NFPA 80 for fire-rated doors.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 33 13

COILING COUNTER DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Counter doors.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of coiling counter door and accessory.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

PART 2 - PRODUCTS

2.1 COUNTER DOOR ASSEMBLY

A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Cookson Company; Rolling Counter Door, or a comparable product by one of the following:

    a. ACME Rolling Doors.
    b. C.H.I. Overhead Doors, Inc.
    c. Cornell Iron Works, Inc.
    d. McKeon Rolling Steel Door Company, Inc.
    e. Overhead Door Corporation.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000.

C. Door Curtain Material: Stainless steel.

D. Door Curtain Slats: Flat profile slats of 1-1/4-inches center-to-center height.

E. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated stainless steel and finished to match door.

F. Curtain Jamb Guides: Stainless steel with exposed finish matching curtain slats.

G. Integral Frame, Hood, and Fascia: Stainless steel.

    1. Mounting: Between jambs.

H. Sill Configuration: Integral stainless steel sill.

I. Locking Devices: Equip door with locking device assembly.

    1. Locking Device Assembly: Masterkeyable cylinder operable from coil side of bottom bar.

J. Manual Door Operator: Push-up operation.

K. Door Finish:
    1. Stainless-Steel Finish: No. 4 (polished directional satin).
    2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.2 COUNTER DOOR ACCESSORIES

A. Integral Metal Sill: Fabricate sills as integral part of frame assembly of Type 304 stainless steel in manufacturer's standard thickness with No. 4 finish.

2.3 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.4 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

B. Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lbf.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion. Lubricate bearings and sliding parts as recommended by manufacturer.

END OF SECTION 08 33 13

SECTION 08 34 83

FLOOR DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes floor doors.

B. Related Requirements:

1. Section 23 05 00 "Basic HVAC Materials and Methods" for wall- and ceiling-mounted access doors and frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Floor Doors: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency according to NFPA 288.

2.2 STEEL FLOOR DOORS

A. Fire-Rated Steel Floor Door:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Frame: Prime-painted steel, angle profile.
3. Door: Single leaf; manufacturer's standard thickness, smooth; prime-painted steel plate; with manufacturer's standard heat-resistant insulation and fire-rated gasket.
4. Loading Capacity: 300-lbf/sq. ft. pedestrian live load.
5. Insulation: Manufacturer's standard, with liner pan.
6. Hardware:

a. Material and Finish: Manufacturer's standard.

b. Hinges: Heavy-duty butt hinges with stainless-steel pins.
c. Operating Mechanism: Heavy-duty hold-open arm that automatically locks door open at 90 degrees with fusible-link to automatically close door in event of fire, release handle with vinyl grip that allows for one-handed closure, adjustable counterbalancing springs, and recessed lift handle.
d. Latch: Stainless-steel slam latch.
e. Lock: Keyed deadbolt lock.

7. Fire-Resistance Rating: Not less than that of adjacent construction.

B. Safety Accessories: Safety [**chains**] [**net**] [**railing**] [**telescoping safety post**] [**grid**] <**Insert safety device**>.

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

E. Frame Anchors: Same material as door face.

F. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

A. General: Provide floor doors manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure floor doors to types of supports indicated.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder locks, furnish two keys per lock and key all locks alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

E. Prime Painted Steel: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

F. Stainless-Steel Finish: Bright, cold-rolled, unpolished No. 2B finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing floor doors.

B. Apply intumescent fireproofing to underside of floor door cover to minimum thickness required by intumescent fireproofing manufacturer for fire rating indicated.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 34 83

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Exterior manual-swing entrance doors.

B. Related Requirements:

1. Section 08 51 13 "Aluminum Windows" for coordinating finish among aluminum fenestration units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. For glazing sealants used on the interior of the building, include a statement of VOC content in g/L.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples: For each exposed finish required.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

E. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. EFCO Corporation.
2. Kawneer North America; an Alcoa company.
3. YKK AP America Inc.

B. Source Limitations: Obtain all components of aluminum windows and aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.3 EXTERIOR STOREFRONT SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America; an Alcoa company; Trifab VG 601T Storefront System.

2.4 INTERIOR STOREFRONT SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America; an Alcoa company; Trifab VG 451 Storefront System.

2.5 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken unless otherwise indicated.
   a. Nonthermal construction may be provided at interior storefront framing.

2. Glazing System:
   a. Retained mechanically with gaskets on four sides.

3. Glazing Plane: Center.
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

   a. Sheet and Plate: ASTM B 209.
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
   d. Structural Profiles: ASTM B 308/B 308M.

2. Internal Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.6 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 2- to 2-1/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

2. Door Design: Wide stile; 5-inch nominal width.

a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

2.7 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."

2.8 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

D. Sealants used on the interior of the building (defined as inside the weatherproofing system and applied on-site) shall comply with VOC limits as specified in South Coast Air Quality Management District (SCAQMD) Rule #1168 effective date of July 1, 2005, and rule amendment date of January 7, 2005, and shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.9 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.10 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.11 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 08 80 00 "Glazing."

F. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 08 41 13

SECTION 08 51 13

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes aluminum windows for exterior locations.

B. Related Requirements:

1. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchorage, flashing, sealing perimeters, and protecting finishes.
4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

C. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: Two (2) years from date of Substantial Completion.
b. Glazing Units: Ten (10) years from date of Substantial Completion.
c. Aluminum Finish: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: AAMA/WDMA/CSA 101/I.S.2/A440.

1. Minimum Performance Class and Grade: CW - 50.

B. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F.

C. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.39.

D. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F material surfaces.

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America; an Alcoa company; AA4325 OptiQ Ultra Thermal Window or comparable product by one of the following:

1. EFCO Corporation.
2. YKK AP America Inc.

2.3 Source Limitations: Obtain all components of aluminum windows and aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.ALUMINUM WINDOWS

A. Operating Types: Fixed.

B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

C. Insulating-Glass Units: ASTM E 2190.

1. Glass: ASTM C 1036, Type 1, Class 1, q3.

a. Tint: Clear.
b. Kind: Fully tempered.

2. Lites: Two.
3. Filling: Fill space between glass lites with argon.
4. Low-E Coating: Sputtered on second or third surface.

D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

2.4 ACCESSORIES

A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

B. Column Covers: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

C. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

D. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

E. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design wind loads of window units.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 08 51 13

SECTION 08 71 00

FINISH HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.

1. Door hardware for steel (hollow metal) doors.
2. Door hardware for aluminum doors.
3. Door hardware for wood doors.
4. Door hardware for other doors indicated.
5. Keyed cylinders as indicated.

B. Related Sections:

1. Division 6: Rough Carpentry.
2. Division 8: Aluminum Doors and Frames
3. Division 8: Hollow Metal Doors and Frames.
4. Division 8: Wood Doors.
5. Division 26 Electrical
6. Division 28: Electronic Security

C. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.

1. Builders Hardware Manufacturing Association (BHMA)
2. NFPA 101 - Life Safety Code
3. NFPA 80 - Fire Doors and Windows
4. ANSI A156.1 - Butts and Hinges
5. ANSI A156.3 - Exit Devices
6. ANSI A156.4 - Door Controls - Closers
7. ANSI A156.5 - Cylinders and Input Devices for Locks
8. ANSI A156.6 - Architectural Door Trim
9. ANSI A156.7 - Template Hinge Dimensions
10. ANSI A156.8 - Door Controls – Overhead Stops and Holders
11. ANSI A156.13 - Mortise Locks & Latches
12. ANSI A156.14 - Sliding and Folding Door Hardware
13. ANSI A156.15 - Release Devices – Closer Holder, Electromagnetic & Electromechanical
14. ANSI A156.16 - Auxiliary Hardware
15. ANSI A156.18 - Materials and Finishes
16. ANSI A156.21 - Thresholds
17. ANSI A156.22 - Door Gasketing and Edge Seal Systems
18. ANSI A156.25 - Electrified Locking Devices
19. ANSI A156.26 - Continuous Hinges
20. ANSI A156.28 - Recommended Practices for Mechanical Keying Systems
21. ANSI A156.29 - Exit Locks, Exit Alarms, Alarms for Exit Devices
22. ANSI A156.30 - High Security Cylinders
23. ANSI A156.36 - Auxilary Locks
24. UL10C – Positive Pressure Fire Test of Door Assemblies
25. ANSI-A117.1 – Accessible and Usable Buildings and Facilities
26. DHI /ANSI A115.IG – Installation Guide for Doors and Hardware

D. Intent of Hardware Groups

1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

E. Allowances

1. Refer to Division 1 for allowance amount and procedures.

F. Alternates

1. Refer to Division 1 for Alternates and procedures.

1.2 SUBSTITUTIONS:

A. Comply with Division 1.

1.3 SUBMITTALS:

A. Comply with Division 1.

B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.

C. Product Data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.
3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
4. Submit 6 copies of catalog cuts with hardware schedule.
5. Provide 9001-Quality Management and 14001-Environmental Management for products listed in Materials Section 2.2

D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.

1. List groups and suffixes in proper sequence.
2. Completely describe door and list architectural door number.
3. Manufacturer, product name, and catalog number.
4. Function, type, and style.
5. Size and finish of each item.
6. Mounting heights.
7. Explanation of abbreviations and symbols used within schedule.

8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.

E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.

F. Samples: (If requested by the Architect)

1. 1 sample of Lever and Rose/Escutcheon design, (pair).
2. 3 samples of metal finishes

G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.

1. Operating and maintenance manuals: Submit 3 sets containing the following.

a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.
c. Name, address, and phone number of local representative for each manufacturer.
d. Parts list for each product.

2. Copy of final hardware schedule, edited to reflect, "As installed".
3. Copy of final keying schedule
4. As installed “Wiring Diagrams” for each piece of hardware connected to power, both low voltage and 110 volts.
5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.4 QUALITY ASSURANCE

A. Comply with Division 1.

1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.

a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
b. Hardware Schedule shall be prepared and signed by an AHC.

4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.

a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.

6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.

B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Comply with Division 1.

1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Package hardware to prevent damage during transit and storage.
3. Mark hardware to correspond with "reviewed hardware schedule".
4. Deliver hardware to door and frame manufacturer upon request.

B. Storage and Protection: Comply with manufacturer's recommendations.

1.6 PROJECT CONDITIONS:

A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.7 WARRANTY:

A. Refer to Conditions of the Contract

B. Manufacturer’s Warranty:

1. Closers: Ten years
2. Exit Devices: Three Years
3. Locksets & Cylinders: Three years
4. All other Hardware: Two years.

1.8 OWNER’S INSTRUCTION:

A. Instruct Owner’s personnel in operation and maintenance of hardware units.

1.9 MAINTENANCE:

A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.

1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.

3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.

B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

Item:	Manufacturer:	Approved:
Hinges	Stanley	Bommer, McKinney
Continuous Hinges	Stanley	Select, ABH
Locksets	Marks	Best, Schlage
Cylinders	Medeco	
Exit Devices	Precision	Von Duprin, Marks
Closers	Marks/ Stanley	Dorma 8900, Norton 7500
Push/Pull Plates	Trimco	Hager, Rockwood
Push/Pull Bars	Trimco	Hager, Rockwood
Protection Plates	Trimco	Hager, Rockwood
Overhead Stops	ABH	Rixson, Glynn Johnson
Door Stops	Trimco	Hager, Rockwood
Flush Bolts	Trimco	ABH, Rockwood
Coordinator & Brackets	Trimco	ABH, Rockwood
Threshold & Gasketing	National Guard	Zero, Reese

2.2 MATERIALS:

A. Hinges:

1. Template screw hole locations
2. Minimum of 2 permanently lubricated non-detachable bearings
3. Equip with easily seated, non-rising pins
4. Sufficient size to allow 180-degree swing of door
5. Furnish hinges with five knuckles and flush [concealed] bearings
6. Provide hinge type as listed in schedule.
7. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
8. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
9. UL10C listed for Fire rated doors.

B. Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10C listed for 3 hour Fire rating
4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 3-hour fire ratings

7. Sufficient size to permit door to swing 180 degrees

C. Electrified Functions for Hinges: Comply with the following:
   1. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle. Provide wire quantity and sizes required for electric hardware be served.
   2. Monitoring: Concealed electrical monitoring switch.
   3. Power Transfer and Monitoring: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle, and with concealed electrical monitoring switch.

D. Mortise Type Locks and Latches:

   1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2 and be UL10C.
   2. Furnish UL or recognized independent laboratory certified mechanical operational testing to 4 million cycles minimum.
   3. Provide 9001-Quality Management and 14001-Environmental Management.
   4. Fit ANSI A115.1 door preparation
   5. Functions and design as indicated in the hardware groups
   6. Solid, one-piece, 3/4-inch (19mm) throw, anti-friction latchbolt made of self-lubricating stainless steel
   7. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel
   8. Latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended
   9. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated
   10. Provide sufficient curved strike lip to protect door trim
   11. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
   12. Lock shall have self-aligning, thru-bolted trim
   13. Levers to operate a roller bearing spindle hub mechanism
   14. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
   15. Spindle to be designed to prevent forced entry from attacking of lever
   16. Provide locksets with 7-pin removable and interchangeable core cylinders
   17. Each lever to have independent spring mechanism controlling it
   18. Core face must be the same finish as the lockset.

E. Exit Devices:

   1. Exit devices to meet or exceed BHMA for ANSI 156.3, Grade 1.
   2. Exit devices to be tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.
   3. Exit devices chassis to be investment cast steel, zinc dichromate.
   4. Exit devices to have stainless steel deadlocking ¾" through latch bolt.
   5. Exit devices to be equipped with sound dampening on touchbar.
   6. Non-fire rated exit devices to have cylinder dogging.
   7. Non-fire rated exit devices to have ¼" minimum turn hex key dogging.
   8. Touchpad to be "T" style constructed of architectural metal with matching metal end caps.
   9. Touchbar assembly on wide style exit devices to have a ¼" clearance to allow for vision frames.
   10. All exposed exit device components to be of architectural metals and "true" architectural finishes.

11. Provide strikes as required by application.
12. Fire exit hardware to conform to UL10C and UBC 7-2. UL tested for Accident Hazard.
13. Exit device to be heavy investment cast stainless steel with black powder coated finish.
14. Exit devices to have field reversible handing.
15. Provide heavy duty vandal resistant lever trim with heavy duty investment cast stainless steel components and extra strength shock absorbing overload springs. Lever shall not require resetting. Lever design to match locksets and latchsets.
16. Provide 9001-Quality Management and 14001-Environmental Management.
17. Vertical Latch Assemblies to have gravity operation, no springs.
18. Approved Manufacturers
    a. The following manufacturers will be approved contingent on meeting or exceeding the above performance criteria:
        1) Precision Manufactured by Stanley Security Solutions

F. Cylinders:

1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
3. Coordinate and provide as required for related sections.

G. Door Closers shall:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1
2. UL10C certified
3. Provide 9001-Quality Management and 14001-Environmental Management.
4. Closer shall have extra-duty arms and knuckles
5. Conform to ANSI 117.1
6. Maximum 2 7/16 inch case projection with non-ferrous cover
7. Separate adjusting valves for closing and latching speed, and backcheck
8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
9. Full rack and pinion type closer with 1½“ minimum bore
10. Mount closers on non-public side of door, unless otherwise noted in specification
11. Closers shall be non-handed, non-sized and multi-sized.

H. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.

1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
2. Provide fastener suitable for wall construction.
3. Coordinate reinforcement of walls where wall stop is specified.
4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered

I. Overhead Stops: Provide a Surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.

1. Concealed overhead stops shall be heavy duty bronze or stainless steel.
2. Surface overhead stops shall be heavy duty bronze or stainless steel.

J. Push Plates: Provide with four beveled edges ANSI J301, .050 thickness, size as indicated in hardware set. Furnish oval-head countersunk screws to match finish.

K. Pulls with plates: Provide with four beveled edges ANSI J301, .050 thickness Plate s with ANSI J401 Pull as listed in hardware set. Provide proper fasteners for door construction.

L. Push Pull Bars: Provide ANSI J504, .1" Dia. Pull and push bar model and series as listed in hardware set. Provide proper fasteners for door construction.

M. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

N. Mop plates: Provide with four beveled edges ANSI J103, 4 inches high by width less 1 inch on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

O. Door Bolts: Flush bolts for wood or metal doors.

1. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 25 for hollow metal label doors.
2. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 27 at wood label doors.
3. Manual flush bolts, Certified ANSI/BHMA 156.16 at openings where allowed local authority.
4. Provide Dust Proof Strike, Certified ANSI/BHMA 156.16 at doors with flush bolts without thresholds.

P. Coordinator and Brackets: Provide a surface mounted coordinator when automatic bolts are used in the hardware set.

1. Coordinator, Certified ANSI/BHMA A1156.3 Type 21A for full width of the opening.
2. Provide mounting brackets for soffit applied hardware.
3. Provide hardware preparation (cutouts) for latches as necessary.

Q. Power Supply: Provide power supply for (ELR) Electric Latch Retraction exit devices

1. Motherboard will accept up to four plug-in Control Modules. Provide the appropriate necessary control module to operate the number of ELR exit devices used at each opening. The Control Module shall include a Time delay Feature, variable (0-4 minutes) latch retraction period in response to a momentary input.
2. UL Listed for class II output
3. Include circuit breakers for protection of motherboard
4. 115 or 230 Volt user selectable switch, with AC input= 115 Volt at 1 Amp
5. Control module shall include Fire alarm terminal and Auxiliary contacts for remote signaling.
6. Optional card for Battery Backup (BT) power tap module to operate a Card reader or when ELR devices require battery backup (Lead Acid Batteries are not included and is to be furnished by others)
7. Precision ELR150 Series with the required modules.

R. Power Supply: PS160 Use with Delayed Egress Devices and a variety of applications including Electric Locking and Exit Alarm The power supply uses 120 VAC at 0.8 amp input. A 230 VAC at 0.3 ampere is available. The power shall be able to control up to (4) Delayed Egress Exit devices. The filtered and regulated output power is field selectable for 12 or 24 VDC at 2 amps.
1. Fire Alarm release that accepts normally closed contact
2. AC input is protected via a manually reset circuit breaker
3. DC output is protected via an auto-reset fuse (PTC)
4. Box shall include a key lock.

S. Quick Connect Power Transfer: Power transfer device shall be a steel housing and flexible tube. Secure and inconspicuous channel is to bring power from the frame to the door.
   1. Precision EPT-12C
   2. Tube shall contain 12 Wire bundle with Stanley Quick Connect Connectors one 4 wire connector consisting of two 18AWG wires and 2 24AWG wires and one 8 wire connector with 8 24AWG wires.

T. Power Transfer: Power transfer device shall be a steel housing and flexible tube. Secure and inconspicuous channel is to bring power from the frame to the door.
   1. Precision EPT-5
   2. Tube shall accept up to 5/16” wire bundle and accommodate a door swing of 120 Deg.
   3. Wires as required by others

U. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.

V. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.

   1. Weatherstrip shall be resilient seal of Neoprene, Polyurethane, Vinyl, Pile, Nylon Brush, or Silicone as specified
   2. UL10C Positive Pressure rated seal set when required.

W. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.

   1. Door seal shall be resilient seal of Neoprene, Polyurethane, Nylon Brush, or Silicone as specified
   2. UL10C Positive Pressure rated seal set when required.

X. Thresholds: Thresholds shall be aluminum beveled type with maximum height of ½” for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.

Y. Provide one wall mounted Telkee, Lund or MMF series key cabinet complete with hooks, index and tags to accommodate 50% expansion. Coordinate mounting location with architect.

Z. Key Control Software: Provide one, Keystone® 600N key management control software. Shall include general features

   1. Password restricted logins.
   2. List all keys and items currently due back (or due back by any day designated)
   3. Lists all cores and their location, building and doors, and cross-references people to cores, doors, and building they access.
   4. Comprehensive list of reports available as an on-screen menu.
   5. Built-in easy to use backup program.
   6. Program always displays date of last backup.
   7. Dynamic searching capabilities for all records.
   8. On-screen indicator shows when historical info. Is present for a record.
   9. On-screen indicator appears when notes are present on a record.
   10. Able to operate in an NTFS network environment with TCPIP protocol
   11. Multiple users can access program at the same time.
   12. Software shall include a “Best” Automated Pin Segment Calculator and a Manual Pin Segment Calculator for authorized “Best” building lock shop facilities.

13. Software program is to be compatible with Windows NT, 2000 or XP with TCPIP protocol.

AA. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

2.3 FINISH:

A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products

B. Powder coat door closers to match other hardware, unless otherwise noted.

C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYS AND KEYING:

A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.

B. Cylinders, removable and interchangeable core system: Medeco X4 SFIC Patented 7-pin.

C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."

D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.

E. Furnish keys in the following quantities:

1. 1 each Grand Masterkeys
2. 4 each Masterkeys
3. 2 each Change keys each keyed core
4. 15 each Construction masterkeys
5. 1 each Control keys

F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.

G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 copies of keying and programming schedule to Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.

1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS:

A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.

1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).

2. Recommended locations for Architectural Hardware for flush wood doors (DHI).

3. WDMA Industry Standard I.S.-1A-04, Industry Standard for Architectural wood flush doors.

3.3 INSTALLATION:

A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

B. Conform to local governing agency security ordinance.

C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.

1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.

D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.

1. Check and adjust closers to ensure proper operation.

2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.

a. Verify levers are free from binding.
b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.

3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.

3.5 SCHEDULE OF FINISH HARDWARE:

Hardware Sets

SET #01 - Office 20M IS

Doors: 102, 103, 104, 106, 107, 108, 109, 112, 113, 382, 284, 285

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Office Lock (F04)	5RW86E G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer	MC400PATPC / QDC111	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA

SET #02 - Privacy 20M IS

Doors: 110, 286, 105

3	Hinges	CB191 4 1/2 X 4 1/2	US32D	ST
1	Privacy Set (F02)	5RW86L	626	BE
1	Door Closer	MC400PATPC / QDC111	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA

SET #03 - Office w.DB 20M IS (Files Rm)

Doors: 111

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Office Lock (F20)	5RW86FD G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer	MC400PATPC / QDC111	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA

SET #04 - Access Control IS

Doors: 371, C203, 114, 243, 316

2	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Hinges	CECB168 4 1/2 X 4 1/2 4' LONG WIRES 54	US26D	ST
1	Electro-mech Lock	5RW86EU G3 W10	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME

1	Door Closer	MC400PATPC / QDC111	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA
1	Door Position Switch	MC-4		SDC
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY

NOTE: OPERATION DESCRIPTION:

SET #05 - Privacy 20M OS

Doors: 119, 136, 137, 153, 287, 115

3	Hinges	CB191 4 1/2 X 4 1/2	US32D	ST
1	Privacy Set (F02)	5RW86L	626	BE
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Gasketing	5050 T-17 17'		NA

SET #06 - Sauna 20M IS

Doors: 116

3	Hinges	CB191 4 1/2 X 4 1/2	US32D	ST
1	Classroom Lock (F05)	5RW86J G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer	MC400PATPC / QDC111	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	110 NA 1 x 36" 2 x 84"		NA

SET #07 - Sleeping 20M OS

Doors: 117, 131, 133, 135, 138, 139

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Passage Set (F01)	5RW86N	626	BE
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Gasketing	5050 T-17 17'		NA

SET #08 - Access Control OS

Doors: 120P, 260, 301, 317, 120, 220, 201A

2	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Hinges	CECB168 4 1/2 X 4 1/2 4' LONG WIRES 54	US26D	ST
1	Electro-mech Lock	5RW86EU G3 W10	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Gasketing	5050 T-17 17'		NA
1	Door Position Switch	MC-4		SDC

1	Wiring Diagram	BY HARDWARE SUPPLIER	BY
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR	BY

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: Door normally closed, latched and secure. Access by presenting valid credentials to card reader or by mechanical key override. With loss of power or activation of fire alarm system secure side of door will remain locked. Free egress at all times.

SET #08.1 - Access Control OS

Doors: 355

2	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Hinges	CECB168 4 1/2 X 4 1/2 4' LONG WIRES 54	US26D	ST
1	Electro-mech Lock	5RW86EU G3 W10	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	D-4551 TCS Pull Side Mount	689	SD
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: Door normally closed, latched and secure. Access by presenting valid credentials to card reader or by mechanical key override. With loss of power or activation of fire alarm system secure side of door will remain locked. Free egress at all times.

SET #08.2 - PR Access Control OS 20M

Doors: 118

5	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Hinges	CECB168 4 1/2 X 4 1/2 4' LONG WIRES 54	US26D	ST
1	Set Semi-Auto Flush Bolts	3825L X 3815L	630	TR
1	Dustproof Strike	3910	630	TR
1	Electro-mech Lock	5RW86EU G3 W10	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
2	Kick Plate	KO050 8" x 1" LDW CSK	630	TR
1	Gasketing	5050 T-20 20'		NA
1	Astragal	BY DOOR MANUFACTURER		BY
2	Door Position Switch	MC-4		SDC
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: Doors normally closed, latched and secure. Access by presenting valid credentials to card reader or by mechanical key override. With loss of power or activation of fire alarm system secure side of door will remain locked. Free egress at all times.

SET #09 - Classoom Intruder 20M OS

Doors: 123, 124

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Classrm Intruder Lk (F32)	5RW86GC G3	626	BE
2	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Gasketing	5050 T-17 17'		NA

SET #10 - Privacy IS OHS

Doors: 120A, 160B, 210, 214, 218, 221, 305, 330

3	Hinges	CB191 4 1/2 X 4 1/2	US32D	ST
1	Privacy Set (F02)	5RW86L	626	BE
1	Overhead Stop	4024	US32D	AB
1	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
3	Door Silencers	1229A	GREY	TR

SET #11 - Storerm NF IS (Hskpg -Kitch Stor)

Doors: 120B, 396A

3	Hinges	CB191 4 1/2 X 4 1/2	US32D	ST
1	Storeroom Lock (F07)	5RW86EW G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #12 - Storeroom IS

Doors: 120C, 225, 250H, 336, 348

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Storeroom Lock (F07)	5RW86EW G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Wall Bumper	1270WX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #13 - Office Lock IS

Doors: 141P, 160D, 202, 206, 207, 208, 209, 211, 213, 215, 216, 217, 231, 250B, 250C, 254, 255, 263, 264, 266, 267, 268, 269, 271C, 271D, 276, 277, 279, 280, 281, 282, 308, 309, 311, 313, 314, 315, 321, 323, 328, 329, 333, 338, 339, 340, 342, 343, 351, 352, 354, 356, 360, 361, 362, 363, 364, 365, 366, 367, 380A, 380B, 380C, 380E, 120D

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Office Lock (F04)	5RW86E G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Wall Bumper	1270WX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #14 - Storeroom OS

Doors: 120J, 120N, 120F

3	Hinges	CB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Storeroom Lock (F07)	5RW86EW G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Wall Bumper	1270WX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #15 - Passage NF OS OHS

Doors: 120G, 120K, 120M

3	Hinges	CB191 4 1/2 X 4 1/2	US32D	ST
1	Privacy Set (F02)	5RW86L	626	BE
1	Overhead Stop	4024	US32D	AB
1	Mop Plate	KM050 4" x 2" LDW CSK	630	TR
3	Door Silencers	1229A	GREY	TR

SET #16 - Classroom IS

Doors: 120I, 120L, 120O, 203, 241, 261, 262, 304, 373, 120H

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Classroom Lock (F05)	5RW86J G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Wall Bumper	1270WX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #17 - Classroom Intruder 20M

Doors: 122

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Classrm Intruder Lk (F32)	5RW86GC G3	626	BE
2	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer	MC400PATPC / QDC111	689	SH
1	Overhead Stop	4024	US32D	AB
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Gasketing	5050 T-17 17'		NA

SET #18 - Classroom Intruder Wide

Doors: 125A

3	Hinges	CB168 5 X 4 1/2	US26D	ST
1	Classrm Intruder Lk (F32)	5RW86GC G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Mop Plate	KM050 4" x 2" LDW CSK	630	TR
1	Floor Stop	1211	626	TR
1	Gasketing	5050 T-20 20'		NA

NOTE: Install lock so Room 128 is outside and Room 125 is inside.

SET #19 - Storeroom 20M OS

Doors: 121, 129, 127

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Storeroom Lock (F07)	5RW86EW G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Gasketing	5050 T-17 17'		NA

SET #20 - Sleeping 20M IS

Doors: 130

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Passage Set (F01)	5RW86N	626	BE
1	Door Closer	MC400PATPC / QDC111	689	SH
1	Overhead Stop	4024	US32D	AB
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Gasketing	5050 T-17 17'		NA

SET #21 - Classroom NF 20M OS

Doors: 132, 132A, 396

3	Hinges	CB199 4 1/2 X 4 1/2 NRP	US32D	ST
1	Classroom Lock (F05)	5RW86J G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Gasketing	5050 T-17 17'		NA

SET #22 - Classroom NF (20M) IS OHS

Doors: 240, 370, 374, 134, 244

3	Hinges	CB199 4 1/2 X 4 1/2	US32D	ST
1	Classroom Lock (F05)	5RW86J G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	D-4551 TCS Pull Side Mount	689	SD
1	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Gasketing	5050 T-17 17'		NA

SET #23 - Mechanical 20M OS

Doors: 141

3	Hinges	CB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Storerm Lock T/O (F07)	5RW86EW G3 A4	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Gasketing	5050 T-17 17'		NA

SET #24 - Mech-Elec OS Wide 60M

Doors: 141O, 141N

3	Hinges	CB168 5 X 4 1/2 NRP	US26D	ST
1	Storerm Lock T/O (F07)	5RW86EW G3 A4	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Gasketing	5050 T-20 20'		NA

SET #25 - Laundry (Classroom) 60M IS

Doors: 150, 291

3	Hinges	CB199 4 1/2 X 4 1/2	US32D	ST
1	Classroom Lock (F05)	5RW86J G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	D-4551 TCS Pull Side Mount	689	SD
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA

SET #26 - Bathroom Multi 20M IS

Doors: 151, 378, 379, 288

3	Hinges	CB199 4 1/2 X 4 1/2	US32D	ST
1	Classroom Lock (F05)	5RW86J G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer	MC400PATPC / QDC111	689	SH
1	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA

SET #27 - Storeroom NF 20M OS

Doors: 229, 292, 152

3	Hinges	CB191 4 1/2 X 4 1/2 NRP	US32D	ST
1	Storeroom Lock (F07)	5RW86EW G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR

1	Gasketing	5050 T-17 17'		NA

SET #28 - Sauna OS

Doors: 155

3	Hinges	CB191 4 1/2 X 4 1/2 NRP	US32D	ST
1	Classroom Lock (F05)	5RW86J G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	110 NA 1 x 36" 2 x 84"		NA

SET #29 - Kitchen OS Wide

Doors: 160, 160A

3	Hinges	CB199 5 X 4 1/2 NRP	US32D	ST
1	Classroom Lock (F05)	5RW86J G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ HO + Stop	QDC118	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
3	Door Silencers	1229A	GREY	TR

SET #30 - Classroom 20M OS

Doors: 201, 293A, 293B

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Classroom Lock (F05)	5RW86J G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer	QDC115	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA

SET #31 - Passage

Doors: 250D, 250G

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Passage Set (F01)	5RW86N	626	BE
1	Wall Bumper	1270WX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #32 - Classroom 20M IS

Doors: 220B, 377

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Classroom Lock (F05)	5RW86J G3	626	BE

1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer	MC400PATPC / QDC111	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA

SET #33 - Ante Room, Lab, Autoclave

Doors: 212, 219, 327, 334, 345

3	Hinges	CB191 4 1/2 X 4 1/2	US32D	ST
1	Classroom Lock (F05)	5RW86J G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #34 - Office Lock - STC

Doors: 222, 223, 226, 205

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Office Lock (F04)	5RW86E G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Stop	1214	626	TR
1	Acoustical Seals	TESTED GASKETING BY DOOR MFGR		BY

SET #35 - Files Office Lk w/ DB IS

Doors: 227, 250F, 380D, 349, 353, 359, 283

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Office Lock (F20)	5RW86FD G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Wall Bumper	1270WX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #36 - Office - STC OS

Doors: 230

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Office Lock (F04)	5RW86E G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Acoustical Seals	TESTED GASKETING BY DOOR MFGR		BY

SET #37 - Elec Rm IS

Doors: 242, 372

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST

1	Storerm Lock T/O (F07)	5RW86EW G3 A4	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Wall Bumper	1270WX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #38 - Office Lock OHS

Doors: 256, 250A

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Office Lock (F04)	5RW86E G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Overhead Stop	4024	US32D	AB
3	Door Silencers	1229A	GREY	TR

SET #39 - Storeroom Lock OHS

Doors: 250I

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Storeroom Lock (F07)	5RW86EW G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Overhead Stop	4024	US32D	AB
3	Door Silencers	1229A	GREY	TR

SET #40 - Compressor STC OS

Doors: 341

3	Hinges	CB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Storeroom Lock (F07)	5RW86EW G3	626	BE
1	Door Stop	1214	626	TR
1	Acoustical Seals	TESTED GASKETING BY DOOR MFGR		BY

SET #41 - Lab - Classroom OS

Doors: 270

3	Hinges	CB191 4 1/2 X 4 1/2 NRP	US32D	ST
1	Classroom Lock (F05)	5RW86J G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Mop Plate	KM050 4" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #42 - Storeroom UL IS

Doors: 289, 290A, 126, 304A, 376

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Storeroom Lock (F07)	5RW86EW G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME

1	Door Closer	MC400PATPC / QDC111	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA

SET #43 - Storeroom NF OS OHS (UL)

Doors: 322, 386

3	Hinges	CB191 4 1/2 X 4 1/2 NRP	US32D	ST
1	Storeroom Lock (F07)	5RW86EW G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
1	Mop Plate	KM050 4" x 2" LDW CSK	630	TR
3	Door Silencers	1229A	GREY	TR

SET #44 - Exam - Operatory

Doors: 344, 346, 324, 326, 331, 332, 335, 337, 347

3	Hinges	CB191 4 1/2 X 4 1/2	US32D	ST
1	Office Lock (F04)	5RW86E G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #44.1 - Exam - Operatory w/ OHS

Doors: 302, 303, 306, 307, 310, 312

3	Hinges	CB191 4 1/2 X 4 1/2	US32D	ST
1	Office Lock (F04)	5RW86E G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Overhead Stop	4024	US32D	AB
1	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
3	Door Silencers	1229A	GREY	TR

SET #45 - Access Control IS TCS

Doors: 368

2	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Hinges	CECB168 4 1/2 X 4 1/2 4' LONG WIRES 54	US26D	ST
1	Electro-mech Lock	5RW86EU G3 W10	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	D-4551 TCS Pull Side Mount	689	SD
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Gasketing	5050 T-17 17'		NA
1	Door Position Switch	MC-4		SDCO
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: Door normally closed, latched and secure. Access by presenting valid credentials to card reader or by mechanical key override. With loss of power or activation of fire alarm system secure side of door will remain locked. Free egress at all times.

SET #46 - Office Lk w/ DB 20M OS

Doors: 380, 381

3	Hinges	CB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Office Lock (F20)	5RW86FD G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA

SET #47 - Not Used

SET #48 - Privacy 20M IS

Doors: 383

3	Hinges	CB191 4 1/2 X 4 1/2	US32D	ST
1	Privacy Set (F02)	5RW86L	626	BE
1	Door Closer w/ Stop	D-4551 TCS Pull Side Mount	689	SD
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
1	Gasketing	5050 T-17 17'		NA

SET #49 - Dormitory Lock 20M

Doors: 385, 387, 388, 389, 390, 391, 392, 393, 394, 384

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Dormitory Lock (F13)	5RW86FW G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer	MC400PATPC / QDC111	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA
1	Auto Door Bottom	335 N 36" END CAPS		NA

SET #50 - Exit 14 20M

Doors: 271A, 275

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST

1	Fire Exit Device	FL 2114 X 4914D	630	PR
1	Door Closer	QDC115	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA

SET #51 - Exit Only Alarm 20M

Doors: 271B

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Fire Exit Device	FL 2101	630	PR
1	Magnetic Lock	350V	28	SDCO
1	Door Closer	QDC115	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA
1	Door Position Switch	MC-4		SDCO

NOTE: COORDINATION WITH ELECTRICAL IS REQUIRED.

OPERATION DESCRIPTION: Door normally closed, latched and secure.No access from pull side of door. Immediate free egress with loss of power or activation of Fire Alarm System.

SET #52 - Exit AC OS

Doors: C309, 250

2	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Elec. Hinge	CECB168 4 1/2 X 4 1/2 54	US26D	ST
1	Exit Device	E2103 X V4908D FSE	630	PR
1	Rim Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer	QDC115	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA
1	Door Position Switch	MC-4		SDCO
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: Door normally closed, latched and secure. Access by presenting valid credentials to card reader or by mechanical key override. With loss of power or activation of fire alarm system secure side of door will remain locked. Free egress at all times.

SET #53 - Exit Only - STC (UL)

Doors: 375, 252

3	Hinges	CB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Exit Only Device	2101	630	PR
1	Door Closer	QDC115	689	SH
1	Wall Bumper	1270WX	626	TR

2	Gasketing	5050 T-17 17'		NA
1	Auto Door Bottom	423 N 35 3/4"		NA
1	Threshold	896 S 36" 1/4-20 MS/LA	AL	NA

NOTE: Install 2 rows silicone seal per manufacturer's instructions to obtain maximum STC.

SET #54 - Exit 08

Doors: 350A, 350B, 350C, 350

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Fire Exit Device	FL 2108 X V4908D	630	PR
1	Rim Cylinder	Medeco X4 SFIC	26	ME
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA

SET #55 - Stair Passage Exit 60M OS

Doors: S101

3	Hinges	CB168 5 X 4 1/2	US26D	ST
1	Fire Exit Device	FL 2114 X 4914D	630	PR
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Floor Stop	1211	626	TR
1	Gasketing	5050 T-20 20'		NA

SET #56 - Stair Passage Exit 60M IS

Doors: S102, S201, S301

3	Hinges	CB168 5 X 4 1/2	US26D	ST
1	Fire Exit Device	FL 2114 X 4914D	630	PR
1	Door Closer w/ Stop	D-4551 TCS Pull Side Mount	689	SD
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Floor Stop	1211	626	TR
1	Gasketing	5050 T-20 20'		NA

SET #57 - Exit 10 60M

Doors: L101A

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Fire Exit Device	FL 2110 X V4908D	630	PR
2	Rim Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Gasketing	5050 T-17 17'		NA

SET #58 - Exit 03 Mech Penthouse 60M

Doors: 401A

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Exit Device	FL 2103 X 4903D KNR	630	PR
1	Rim Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer	QDC115	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Floor Stop	1211	626	TR
1	Gasketing	5050 T-17 17'		NA

SET #59 - PR EXTER Dbl Cyl Lock

Doors: C208

6	Hinges	CB191 4 1/2 X 4 1/2 NRP	US32D	ST
1	Set Semi-Auto Flush Bolts	3825L X 3815L	630	TR
1	Dustproof Strike	3910	630	TR
1	Storeroom Lock (F35)	5RW86C G3	626	BE
2	Mortise Cylinder	Medeco X4 SFIC	26	ME
2	Door Closer w/ Stop	D-4551 TCS Pull Side Mount	689	SD
1	Drip Strip	17 76"		NA
1	Gasketing	110 NA 1 x 72" 2 x 84"		NA
1	Astragal	BY DOOR MANUFACTURER		BY
2	Door Sweep	200 NA 36"		NA
1	Saddle Threshold	425	AL	NA

SET #60 - PR Exit AC IC

Doors: 101, L101

1	Elec. Hinge	CECB168 4 1/2 X 4 1/2 54	US26D	ST
5	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Exit Device	2701 CD	630	PR
1	Exit Device	E2703 X V4908D CD FSE	630	PR
2	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Rim Cylinder	Medeco X4 SFIC	26	ME
2	Door Closer w/ HO + Stop	QDC118	689	SH
1	Wall Bumper	1270WX	626	TR
2	Door Silencers	1229A	GREY	TR
2	Door Position Switch	MC-4		SD
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY
1	Intercom System	BY OWNER'S SECURITY CONTRACTOR		BY
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
1	Power Supply	PS160-6		PR

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: Door normally closed, latched and secure. Access by presenting valid credentials to card reader or by mechanical key override. With loss of power or activation of fire alarm system secure side of door will remain locked. Free egress at all times.

SET #61 - PR Classroom Intruder 20M OS

Doors: 125

6	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST

1	Set Auto Flush Bolts	3815L X 3815L	626	TR
1	Dustproof Strike	3910	630	TR
1	Classrm Intruder Lk (F32)	5RW86GC G3	626	BE
2	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Coordinator	3094B2	PC	TR
2	Mounting Bracket	3095 or 3096 as Req'd	BLACK	TR
2	Door Closer	QDC115	689	SH
2	Kick Plate	KO050 8" x 1" LDW CSK	630	TR
2	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-20 20'		NA
1	Astragal	BY DOOR MANUFACTURER		BY

SET #62 - PR Exit Passage 20M

Doors: 128

6	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
2	Exit Device	FL 2714 X 4914D LBR	630	PR
2	Door Closer w/ Stop	QDC113	689	SH
2	Kick Plate	KO050 8" x 1" LDW CSK	630	TR
1	Gasketing	5050 T-20 20'		NA
1	Smoke Seal Meeting Stiles	5070 B 84"		NA

SET #63 - PR Exit AC 20M

Doors: 154

5	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Elec. Hinge	CECB168 4 1/2 X 4 1/2 54	US26D	ST
1	Fire Exit Device	FL 2701	630	PR
1	Exit Device	FL E2703 X V4908D FSE	630	PR
1	Rim Cylinder	Medeco X4 SFIC	26	ME
2	Door Closer w/ Stop	QDC113	689	SH
1	Gasketing	5050 T-20 20'		NA
1	Smoke Seal Meeting Stiles	5070 B 84"		NA
2	Door Position Switch	MC-4		SDCO
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY
1	Power Supply	PS160-6		PR

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: Door normally closed, latched and secure. Access by presenting valid credentials to card reader or by mechanical key override. With loss of power or activation of fire alarm system secure side of door will remain locked. Free egress at all times.

SET #64 - PR Storeroom NF IS OHS

Doors: 160C

6	Hinges	CB199 4 1/2 X 4 1/2	US32D	ST
1	Set Semi-Auto Flush Bolts	3825L X 3815L	630	TR
1	Dustproof Strike	3910	630	TR
1	Storeroom Lock (F07)	5RW86EW G3	626	BE

1	Mortise Cylinder	Medeco X4 SFIC	26	ME
2	Overhead Stop	1023 SL	US32D	AB
4	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
1	Astragal	BY DOOR MANUFACTURER		BY
2	Door Silencers	1229A	GREY	TR

SET #65 - PR AC 20M IS

Doors: 160E

5	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Hinges	CECB168 4 1/2 X 4 1/2 4' LONG WIRES 54	US26D	ST
1	Set Semi-Auto Flush Bolts	3825L X 3815L	630	TR
1	Dustproof Strike	3910	630	TR
1	Electro-mech Lock	5RW86EU G3 W10	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Coordinator	3094B2	PC	TR
2	Mounting Bracket	3095 or 3096 as Req'd	BLACK	TR
2	Door Closer	MC400PATPC / QDC111	689	SH
2	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
2	Kick Plate	KO050 8" x 1" LDW CSK	630	TR
2	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-20 20'		NA
1	Astragal	BY DOOR MANUFACTURER		BY
2	Door Position Switch	MC-4		SDCO
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: Door normally closed, latched and secure. Access by presenting valid credentials to card reader or by mechanical key override. With loss of power or activation of fire alarm system secure side of door will remain locked. Free egress at all times.

SET #66 - PR Closet OS

Doors: 203A, 220A, 350D, 350E, 350F, 350G

6	Hinges	CB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Set Semi-Auto Flush Bolts	3825L X 3815L	630	TR
1	Dustproof Strike	3910	630	TR
1	Storeroom Lock (F07)	5RW86EW G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
2	Overhead Stop	4024	US32D	AB
0	Wall Bumper	1270WX	626	TR
1	Astragal	BY DOOR MANUFACTURER		BY
2	Door Silencers	1229A	GREY	TR

NOTE: Wall bumper may be provided in lieu of overhead stop at 90 degree walls.

SET #67 - PR Storeroom IS OHS

Doors: 253A

6	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Set Semi-Auto Flush Bolts	3825L X 3815L	630	TR
1	Dustproof Strike	3910	630	TR
1	Storeroom Lock (F07)	5RW86EW G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
2	Overhead Stop	1023 SL	US32D	AB
1	Astragal	BY DOOR MANUFACTURER		BY
2	Door Silencers	1229A	GREY	TR

SET #68 - PR Office w/DB IS

Doors: 257

6	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Set Semi-Auto Flush Bolts	3825L X 3815L	630	TR
1	Dustproof Strike	3910	630	TR
1	Office Lock (F20)	5RW86FD G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
2	Overhead Stop	1023 SL	US32D	AB
1	Astragal	BY DOOR MANUFACTURER		BY
2	Door Silencers	1229A	GREY	TR

SET #69 - PR AC IS

Doors: 258

5	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Hinges	CECB168 4 1/2 X 4 1/2 4' LONG WIRES 54	US26D	ST
1	Set Semi-Auto Flush Bolts	3825L X 3815L	630	TR
1	Dustproof Strike	3910	630	TR
1	Electro-mech Lock	5RW86EU G3 W10	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer	MC400PATPC / QDC111	689	SH
1	Overhead Stop	1023 SL	US32D	AB
2	Kick Plate	KO050 8" x 1" LDW CSK	630	TR
1	Astragal	BY DOOR MANUFACTURER		BY
2	Door Silencers	1229A	GREY	TR
2	Door Position Switch	MC-4		SDCO
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: Door normally closed, latched and secure. Access by presenting valid credentials to card reader or by mechanical key override. With loss of power or activation of fire alarm system secure side of door will remain locked. Free egress at all times.

SET #70 - PR Bi-Fold

Doors: 265

1	Bifold Hardware Set	BFC125N-02-48		ST
1	Cabinet Knob	7300-1-1/4	626	TR

SET #71 - PR Storeroom NF OS

Doors: 397, 294

6	Hinges	CB191 4 1/2 X 4 1/2 NRP	US32D	ST
1	Set Auto Flush Bolts	3815L X 3815L	626	TR
1	Dustproof Strike	3910	630	TR
1	Storeroom Lock (F07)	5RW86EW G3	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
2	Overhead Stop	4024	US32D	AB
2	Mop Plate	KM050 4" x 1" LDW CSK	630	TR
1	Astragal	BY DOOR MANUFACTURER		BY
2	Door Silencers	1229A	GREY	TR

SET #72 - PR Exit AC Both Sides 20M

Doors: C207

6	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Fire Exit Device	FL 2701	630	PR
1	Fire Exit Device	FL 2703 X 4903D	630	PR
1	Rim Cylinder	Medeco X4 SFIC	26	ME
1	Double Magnetic Lock	352V		SDCO
2	Door Closer w/ Stop	QDC113	689	SH
2	Kick Plate	KO050 8" x 1" LDW CSK	630	TR
1	Smoke Seal Meeting Stiles	5070 B 84"		NA
1	Gasketing	5050 T-20 20'		NA
2	Door Position Switch	MC-4		SDCO
1	Power Supply	PS160-6		PR
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
2	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY IS REQUIRED.

OPERATION DESCRIPTION: Doors normally closed, latched and secure. Access/ egress in either direction by presenting valid credentials to card reader on either side of the doors. With loss of power or activation of Fire Alarm System the push side of the doors will allow immediate free egress.

SET #73 - PR Elec. Closet 20M OS

Doors: EL01, EL02, EL03, EL04, EL05, EL08, EL11, EL10

6	Hinges	CB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Set Semi-Auto Flush Bolts	3825L X 3815L	630	TR
1	Dustproof Strike	3910	630	TR
1	Storerm Lock T/O (F07)	5RW86EW G3 A4	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	QDC113	689	SH
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-20 20'		NA
1	Astragal	BY DOOR MANUFACTURER		BY

SET #74 - PR Elec Closet OS

Doors: EL07, EL09, EL06

6	Hinges	CB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Set Semi-Auto Flush Bolts	3825L X 3815L	630	TR
1	Dustproof Strike	3910	630	TR
1	Storerm Lock T/O (F07)	5RW86EW G3 A4	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-20 20'		NA
1	Astragal	BY DOOR MANUFACTURER		BY

SET #75 - PR Mech Penthouse

Doors: 401B

6	Hinges	CB191 4 1/2 X 4 1/2 NRP	US32D	ST
1	Set Semi-Auto Flush Bolts	3825L X 3815L	630	TR
1	Dustproof Strike	3910	630	TR
1	Storerm Lock T/O (F07)	5RW86EW G3 A4	626	BE
1	Mortise Cylinder	Medeco X4 SFIC	26	ME
2	Overhead Stop	4024	US32D	AB
1	Drip Strip	17 76"		NA
1	Gasketing	110 NA 1 x 72" 2 x 84"		NA
1	Astragal	BY DOOR MANUFACTURER		BY
2	Door Sweep	200 NA 36"		NA
1	Saddle Threshold	425	AL	NA

SET #76 - PR EXTER Exit Access Control OS

Doors: E111

1	Continuous Hinge	662HD UL 83"	AL	ST
1	Continuous Hinge	662HD UL 83" EPT Prep	AL	ST
1	Power Transfer	EPT-5		PR
1	Exit Device	2801 CD	630	PR
1	Exit Device	E2803 X V4908D CD FSE	630	PR
1	Rim Cylinder	Medeco X4 SFIC	26	ME
2	Mortise Cylinder	Medeco X4 SFIC	26	ME
2	Door Closer	QDC119	689	SH
2	Kick Plate	KO050 8" x 1" LDW CSK	630	TR
1	Drip Strip	17 76"		NA
1	Gasketing	110 NA 1 x 72" 2 x 84"		NA
1	Astragal Set	115 NA SET 83"		NA
2	Door Sweep	200 NA 36"		NA
1	Saddle Threshold	425	AL	NA
2	Door Position Switch	MC-4		SDCO
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY
1	Power Supply	PS160-6		PR

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: Doors normally closed, latched and secure. Access by presenting valid credentials to card reader which will release outside lever of exit device or by mechanical key override. Exit devices are equipped with cylinder dogging allowing an authorized person to

temporarily allow doors to function as push-pull (such as during a delivery) and door position switches for remote monitoring. With loss of power the secure side of the doors will remain locked unless dogged by cylinder inside. Free egress at all times.

SET #77 - PR EXTER Exit Only

Doors: E112

2	Continuous Hinge	662HD UL 83"	AL	ST
1	Removable Mullion	KR822 MCS	600	PR
1	Rim Cylinder	Medeco X4 SFIC	26	ME
2	Exit Only Device	2101	630	PR
2	Door Closer	QDC119	689	SH
2	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Drip Strip	17 76"		NA
1	Gasketing	110 NA 1 x 72" 2 x 84"		NA
1	Mullion Seal	5100		NA
2	Door Sweep	200 NA 36"		NA
1	Saddle Threshold	425	AL	NA
2	Door Position Switch	MC-4		SDCO

SET #78 - PR EXTER Exit Elec w/ AC

Doors: E116, E117

1	Continuous Hinge	662HD UL 83"	AL	ST
1	Continuous Hinge	662HD UL 83" EPT Prep	AL	ST
1	Power Transfer	EPT-5		PR
1	Removable Mullion	KR822 MCS	600	PR
1	Exit Only Device	2101	630	PR
1	Exit Device	E2103 X V4908D FSE KNR	630	PR
2	Rim Cylinder	Medeco X4 SFIC	26	ME
2	Door Closer	QDC119	689	SH
2	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Drip Strip	17 76"		NA
1	Gasketing	110 NA 1 x 72" 2 x 84"		NA
1	Mullion Seal	5100		NA
2	Door Sweep	200 NA 36"		NA
1	Saddle Threshold	425	AL	NA
2	Door Position Switch	MC-4		SDCO
1	Power Supply	PS160-6		PR
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY IS REQUIRED.

OPERATION DESCRIPTION: Doors normally closed, latched and secure. Access by presenting valid credentials to reader or by mechanical key override. With loss of power the doors will remain locked. Free egress at all times.

SET #79 - PR Exit AC 20M EHO

Doors: L301, L201

5	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Elec. Hinge	CECB168 4 1/2 X 4 1/2 54	US26D	ST
1	Fire Exit Device	FL 2701	630	PR
1	Exit Device	FL E2703 X V4908D FSE	630	PR
1	Rim Cylinder	Medeco X4 SFIC	26	ME
2	Door Closer Elec. HO	D-4551 EH	689	SD
1	Gasketing	5050 T-20 20'		NA
1	Smoke Seal Meeting Stiles	5070 B 84"		NA
2	Door Position Switch	MC-4		SDCO
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY
1	Power Supply	PS160-6		PR

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: During Business Hours doors held open by electro-mecanical door closers tied into building fire-alarm system. After Hours doors normally closed, latched and secure. Access by presenting valid credentials to card reader or by mechanical key override. With loss of power or activation of fire-alarm systems doors will be closed and locked on secure side. Free egress at all times.

SET #80 - EXTER Exit Only

Doors: E114, E115, E118, E113, E107, E108, E103

1	Continuous Hinge	662HD UL 83"	AL	ST
1	Exit Only Device	2101 LD	630	PR
1	Door Closer	QDC119	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Drip Strip	17 76"		NA
1	Gasketing	110 NA 1 x 36" 2 x 84"		NA
1	Door Sweep	200 NA 36"		NA
1	Saddle Threshold	425	AL	NA
1	Door Position Switch	MC-4		SDCO

NOTE: OPERATION DESCRIPTION: No access from exterior. Free egress at all times. Remote monitoring of door.

SET #81 - Exit AC UL

Doors: L201A, L301A

2	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Elec. Hinge	CECB168 4 1/2 X 4 1/2 54	US26D	ST
1	Exit Device	FL E2103 X V4908D FSE	630	PR
1	Rim Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer	QDC115	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Wall Bumper	1270WX	626	TR
1	Gasketing	5050 T-17 17'		NA
1	Door Position Switch	MC-4		SDCO
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: Door normally closed, latched and secure. Access gained by presenting valid credentials to card reader or by mechanical key override. With activation of fire-alarm system or loss of power the secure side of the door will remain locked. Free egress at all times.

SET #82 - Stair AC Exit 60M IS

Doors: S302, S202

2	Hinges	CB168 5 X 4 1/2	US26D	ST
1	Elec. Hinge	CB168 5 X 4 1/2 54	US26D	ST
1	Exit Device	FL E2103 X V4908D FSE	630	PR
1	Rim Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer w/ Stop	D-4551 TCS Pull Side Mount	689	SD
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Floor Stop	1211	626	TR
1	Gasketing	5050 T-20 20'		NA
1	Door Position Switch	MC-4		SDCO
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY
1	Power Supply	PS160-6		PR

NOTE: COORDINATION WITH ELECTRICAL AND SECUIRTY REQUIRED.

OPERATION DESCRIPTION: Door normally closed, latched and secure. Access gained by presenting valid credentials to card reader or by mechanical key override. With activation of fire-alarm system or loss of power door will remain locked on secure side. Free egress at all times.

SET #83 - Stair Passage Exit 60M IS

Doors: S401

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Fire Exit Device	FL 2114 X 4914D	630	PR
1	Door Closer	MC400PATPC / QDC111	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Floor Stop	1211	626	TR
1	Gasketing	5050 T-20 20'		NA

SET #84 - EXTER Exit Roof

Doors: 401C

1	Continuous Hinge	662HD UL 83"	AL	ST
1	Passage Set (F01)	5RW86N	626	BE
1	Door Closer	QDC119	689	SH
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Drip Strip	17 76"		NA
1	Gasketing	110 NA 1 x 36" 2 x 84"		NA
1	Door Sweep	200 NA 36"		NA
1	Saddle Threshold	425	AL	NA
1	Door Position Switch	MC-4		SDCO

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQURED.

OPERATION DESCRIPTION: Door normally closed and latched. Free egress from either direction at all times. Remote monitoring.

SET #85 - EXTER Exit AC

Doors: E105, E106, E104, E109

1	Continuous Hinge	662HD UL 83" EPT Prep	AL	ST
1	Power Transfer	EPT-5		PR
1	Exit Device	E2103 X V4908D FSE	630	PR
1	Rim Cylinder	Medeco X4 SFIC	26	ME
1	Door Closer	D-4551 EDA P45HD-110	689	SD
1	Overhead Stop	1023 SL	US32D	AB
1	Kick Plate	KO050 8" x 2" LDW CSK	630	TR
1	Drip Strip	17 40"		NA
1	Gasketing	110 NA 1 x 36" 2 x 84"		NA
1	Door Sweep	200 NA 36"		NA
1	Saddle Threshold	425	AL	NA
1	Door Position Switch	MC-4		SDCO
1	Wiring Diagram	BY HARDWARE SUPPLIER		BY
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: Door normally closed, latched and secure. Momentary access by presenting valid credential to reader or by mechanical key override. With loss of power the exterior of the door will remain locked. Immediate free egress at all times.

SET #90 - PR EXTER AL Exit AC

Doors: E101

1	Continuous Hinge	661HD UL 83"	AL	ST
1	Continuous Hinge	661HD UL 83" EPT Prep	AL	ST
1	Power Transfer	EPT-5		PR
1	Exit Device	2601 CD	630	PR
1	Exit Device	ELR 2603 CD	630	PR
2	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Rim Cylinder	Medeco X4 SFIC	26	ME
2	Door Pull	1191-4J	630	TR
2	Door Closer	D-4550 EDA P45-180D	689	SD
2	Overhead Stop	1023 SL	US32D	AB
1	Gasketing	BY ALUMINUM DOOR MANUFACTURER		BY
1	Threshold	BY ALUMINUM DOOR MANUFACTURER		BY
2	Door Position Switch	MC-4		SDCO
1	Power Supply	ELR151		PR
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIRED.

OPERATION DESCRIPTION: Doors normally closed, latched and secure. During Normal Business Hours exit devices can be mechanically dogged with a key by authorized person or electrically dogged from remote location (-- currently only one device is equipped with ELR) for push-pull operation. After Hours access by presenting valid credentials to card reader or by mechanical key override. With loss of power the doors will remain locked on the secure side unless mechanically dogged. Free egress at all times.

SET #91 - PR EXTER AL Exit AC IC

Doors: E102

1	Continuous Hinge	661HD UL 83"	AL	ST
1	Continuous Hinge	661HD UL 83" EPT Prep	AL	ST
1	Power Transfer	EPT-5		PR
1	Exit Device	2601 CD	630	PR
1	Exit Device	ELR 2603 CD	630	PR
2	Mortise Cylinder	Medeco X4 SFIC	26	ME
1	Rim Cylinder	Medeco X4 SFIC	26	ME
2	Door Pull	1191-4J	630	TR
2	Door Closer	D-4550 EDA P45-180D	689	SD
2	Overhead Stop	1023 SL	US32D	AB
1	Gasketing	BY ALUMINUM DOOR MANUFACTURER		BY
1	Threshold	BY ALUMINUM DOOR MANUFACTURER		BY
2	Door Position Switch	MC-4		SDCO
1	Power Supply	ELR151		PR
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY
1	Intercom System	BY OWNER'S SECURITY CONTRACTOR		BY

SET #92 - EXTER AL Exit Only

Doors:

1	Continuous Hinge	661HD UL 83"	AL	ST
1	Exit Device	2601 LD	630	PR
1	Door Closer	D-4550 EDA P45-180D	689	SD
1	Overhead Stop	1023 SL	US32D	AB
1	Gasketing	BY ALUMINUM DOOR MANUFACTURER		BY
1	Threshold	BY ALUMINUM DOOR MANUFACTURER		BY
1	Door Position Switch	MC-4		SDCO

SET #93 - EXTER AL Exit AC

Doors:

1	Continuous Hinge	661HD UL 83" EPT Prep	AL	ST
1	Power Transfer	EPT-5		PR
1	Exit Device	ELR 2403 X 2903D	630	PR
1	Door Closer	D-4550 EDA P45-180D	689	SD
1	Overhead Stop	1023 SL	US32D	AB
1	Gasketing	BY ALUMINUM DOOR MANUFACTURER		BY
1	Threshold	BY ALUMINUM DOOR MANUFACTURER		BY
1	Door Position Switch	MC-4		SDCO
1	Power Supply	ELR151		PR
1	Card Reader	BY OWNER'S SECURITY CONTRACTOR		BY

NOTE: COORDINATION WITH ELECTRICAL AND SECURITY REQUIED.

OPERATION DESCRIPTION: Door normally closed, latched and secure. Access by presenting valid credentials to card reader or by mechanical key override. With loss of power secure side of door will remain locked. Free egress at all times.

END OF SECTION 08 71 00

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Glass for windows, doors, and storefront framing.
2. Glazing sealants and accessories.

B. Related Requirements:

1. Section 08 88 13 "Fire-Resistant Glazing."
2. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for mirrors.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. For field-applied glazing sealants used on the interior of the building, include a statement of VOC content in g/L.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For glass.

C. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AGC Glass Company North America, Inc.

2. Guardian Industries Corp.; SunGuard.

3. PPG Industries, Inc.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings.

C. Safety Glazing: Where safety glazing is indicated or required by codes, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick,

2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.

4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.

5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Glazing Manual."

2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."

3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."

4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

E. Strength:

1. Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article.

2. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article.

3. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Ceramic-Coated Spandrel Glass: ASTM C 1048, Type I, Condition B, Quality-Q3.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Aluminum with mill or clear anodic finish.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealants used on the interior of the building (defined as inside of the weatherproofing system and applied on-site), shall comply with VOC limits as specified in South Coast Air Quality Management District (SCAQMD) Rule #1168 effective date of July 1, 2005, and rule amendment date of January 7, 2005, and shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Corning Corporation; 795.
b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS2000 SilPruf.
c. May National Associates, Inc.; a subsidiary of Sika Corporation; Bondaflex Sil 295.
d. Pecora Corporation; 896.
e. Sika Corporation; Sikasil WS-295.
f. Tremco Incorporated; Spectrem 3.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-In Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC-GLASS SCHEDULE

A. Glass Type GL-1: Clear annealed float glass.

1. Minimum Thickness: 6 mm.

B. Glass Type GL-2: Clear fully tempered float glass.

1. Minimum Thickness: 6 mm.

2. Safety glazing required.

3.9 INSULATING-GLASS SCHEDULE

A. Glass Type GL-3: Low-e-coated, clear insulating glass.

1. Overall Unit Thickness: 1 inch.

2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Fully tempered float glass.
6. Low-E Coating: Sputtered on second or third surface.
7. Visible Light Transmittance: 70 percent minimum.
8. Winter Nighttime U-Factor: 0.24 maximum.
9. Solar Heat Gain Coefficient: 0.39 maximum.
10. Provide safety glazing labeling.

B. Glass Type GL-4: Ceramic-coated, low-E, insulating spandrel glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Fully tempered float glass.
6. Low-E Coating: Pyrolytic or sputtered on second or third surface.
7. Opaque Coating Location: Fourth surface.
8. Coating Color: As selected by Architect from manufacturer's full range.

C. Glass Type GL-5: Low-E-coated, transluscent insulating glass.

1. Overall Unit Thickness: 1 inch
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Fully tempered float glass with Acid-etch on third surface: Texture Opaque.
6. Low-E Coating: Sputtered on second or third surface.

D. Glass Type GL-6: One-Way Vision Glass

1. Overall Unit Thickness: 1 inch
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite (Toilet Room side): Highly Reflective Coated Glass for One-Way Vision
   a. Pilkington Mirropane or approved equal
   b. Glass Substrate: Grey
   c. Visible Light Transmittance: 11 percent minimum.
   d. Mirror Coating number 1 surface, on Toilet Room side.
4. Indoor Lite: Float glass.

E. Insulating Glass for Exterior Doors:

1. Overall Unit Thickness: 1 inch
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: Argon
5. Indoor Lite: Fully tempered float glass.
6. Low-E Coating: Sputtered on second or third surface.
7. Visible Light Transmittance: 70 percent minimum.
8. Winter Nighttime U-Factor: 0.24 maximum.
9. Solar Heat Gain Coefficient: 0.39 maximum.
10. Location: Glazed exterior doors.

END OF SECTION 08 80 00

SECTION 08 88 13

FIRE-RESISTANT GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-protection-rated glazing.
2. Fire-resistance-rated glazing.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. For field-applied glazing sealants used on the interior of the building, include a statement of VOC content in g/L.

B. Glass Samples: For each type of glass product; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers and glass testing agency.

B. Product Certificates: For each type of glass and glazing product, from manufacturer.

C. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during the remainder of the construction period.

1.10 WARRANTY

A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

B. Safety Glazing Labeling: Permanently mark glazing with certification label of the Safety Glazing Certification Council (SGCC) or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.4 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.5 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.

1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test.

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F temperature-rise limitation; and the fire-resistance rating in minutes.

C. Laminated Ceramic Glazing: Laminated glass made from two plies of clear, ceramic glass; 8-mm total thickness; and complying with 16 CFR 1201, Category II.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Interedge Technologies; Pyran Platinum L.
b. Safti First; Pyran Platinum L
c. Schott North America, Inc.; Pyran Platinum L.
d. Technical Glass Products; FireLite Plus.
e. Vetrotech Saint-Gobain; SGG Keralite FR-L.

2.6 FIRE-RESISTANCE-RATED GLAZING

A. Fire-Resistance-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-resistance ratings indicated, based on testing according to ASTM E 119 or UL 263.

B. Fire-Resistance-Rated Glazing Labeling: Permanently mark fire-resistance-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, that the glazing is approved for use in walls, and the fire-resistance rating in minutes.

C. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, ultraclear float glass; with intumescent interlayers; and complying with 16 CFR 1201, Category II.

1. Products: Subject to compliance with requirements, provide one of the following:

a. InterEdge; Pyrobel.
b. Pilkington North America Inc.; Pyrostop.
c. Technical Glass Products; Pyrostop.
d. Vetrotech Saint-Gobain; SGG Contraflam.

2.7 GLAZING ACCESSORIES

A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 795.
b. GE Advanced Materials - Silicones; SilGlaze II SCS2800.
c. Tremco Incorporated; Spectrem 2.

2. Sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site), shall comply with VOC limits as specified in South Coast Air Quality Management District (SCAQMD) Rule #1168 effective date of July 1, 2005, and rule amendment date of January 7, 2005, and shall have a VOC content of 250 g/L or less.

3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.

D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

C. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial washaway from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Remove and replace glass that is damaged during construction period.

3.8 FIRE-RESISTANT GLAZING SCHEDULE

A. Glass Type FPGL-1: 20-minute fire-protection-rated glazing with hose-stream test; laminated ceramic glazing.

B. Glass Type FPGL-2: 20-minute fire-resistance-rated glazing with 450 deg F temperature-rise limitation; laminated glass with intumescent interlayers.

C. Glass Type FRGL-3: 60-minute fire-resistance-rated glazing with 450 deg F temperature-rise limitation; laminated glass with intumescent interlayers.

END OF SECTION 08 88 13

Addendum #03

SECTION 08 91 19

FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fixed, extruded-aluminum louvers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

D. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Airolite Company, LLC (The); K638HP Drainable Louver or comparable product by one of the following:

a. All-Lite Architectural Products.
b. Construction Specialties, Inc.
c. Reliable Products, Inc.
d. Ruskin Company.

2. Louver Depth: 4 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
4. Mullion Type: Exposed.
5. Louver Performance Ratings:

a. Free Area: Not less than 8.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
b. Point of Beginning Water Penetration: Not less than 850 fpm.
c. Air Performance: Not more than 0.15-inch wg static pressure drop at 850 fpm free-area velocity.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening.

B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.

C. Louver Screening for Aluminum Louvers:

1. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inch wire.

a. Locations: Provide behind louver areas for mechanical intake or exhaust of air.

2. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

a. Locations: Provide behind other louver areas or vents not requiring bird screens.

2.5 BLANK-OFF PANELS

A. Insulated, Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.

1. Thickness: 1 inch.
2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
3. Insulating Core: Rigid, glass-fiber-board insulation or extruded-polystyrene foam.
4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch nominal thickness, with corners mitered and with same finish as panels.
5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
6. Panel Finish: Same finish applied to louvers.
7. Attach blank-off panels with clips.

2.6 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.7 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
2. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

G. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.8 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 19

DIVISION 09 – FINISHES

SECTION 09 21 16.23

GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Gypsum board shaft wall assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly, including the following:

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project and fraction by weight that is considered regional.

B. Manufacturer's written installation instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated on Drawings.

B. STC Rating: As indicated on Drawings.

C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.

1. Depth: As indicated on Drawings.
2. Minimum Base-Metal Thickness: 0.018 inch, 25 gage.

D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.

1. Minimum Base-Metal Thickness: Matching steel studs.

E. Room-Side Finish: Gypsum Board.

F. Shaft-Side Finish: Gypsum Shaftliner Board, Type X.

2.3 PANEL PRODUCTS

A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent by weight.

B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

C. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

D. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corporation; ProRoc Shaftliner.
    b. Continental Building Products, LLC; Firecheck Type X Shaftliner.
    c. Georgia-Pacific Building Products; ToughRock Fireguard Shaftliner.
    d. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner.
    e. United States Gypsum Company; Sheetrock Brand Gypsum Liner Panel.

2. Thickness: 1 inch.
3. Long Edges: Double bevel.

E. Gypsum Board: As specified in Section 09 29 00 "Gypsum Board."

2.4 NON-LOAD-BEARING STEEL FRAMING

A. Recycled Content of Steel: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Framing Members: Comply with ASTM C 645 requirements for metal.

1. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 unless otherwise indicated.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.

B. Trim Accessories: Material and shapes as specified in Section 09 29 00 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing according to ASTM E 488 conducted by a qualified testing agency.
2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.

E. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.

B. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.

C. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices and similar items.

D. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

E. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.

F. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 21 16.23

SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:

1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For embossed steel studs and runners, from ICC-ES.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: Manufacturer's standard, hot-dip galvanized unless otherwise indicated.

C. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or embossed steel studs and runners of equivalent minimum base-metal thickness.

1. Steel Studs and Runners:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Craco Mfg., Inc.
2) MRI Steel Framing. LLC.
3) Steel Network, Inc. (The).
4) Steel Structural Systems.

b. Minimum Base-Metal Thickness: 0.033 inch, 20-gage, unless otherwise indicated.

c. Depth: 3-5/8 inches, unless otherwise indicated.

2. Embossed Steel Studs and Runners:

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) ClarkDietrich Building Systems; ProSTUD Drywall Framing System.

b. Minimum Base-Metal Thickness: 0.019 inch, 20-gage equivalent, unless otherwise indicated.

c. Depth: 3-5/8 inches, unless otherwise indicated.

D. Slip-Type Head Joints: Where indicated, provide the following in thickness not less than indicated for studs and in width to accommodate depth of studs:

1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges and fastened to studs, and outer runner sized to friction fit inside runner.

E. Firestop Tracks: Manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.

2) Grace Construction Products; W.R. Grace & Co. – Conn.; FlameSafe FlowTrak System.
3) Metal-Lite; The System.

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated on Drawings.

1. Minimum Base-Metal Thickness: 0.033 inch, 20-gage.

G. Cold-Rolled Channel Bridging: Steel, 0.053-inch, 16-gage, minimum base-metal thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.079-inch-, 14-gage, thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.033 inch, 20-gage.
2. Depth: As indicated on Drawings.

I. Cold-Rolled Furring Channels: 0.053-inch, 16-gage, uncoated-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: As indicated on Drawings.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch, 20-gage.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, 26-gage, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch, 16-gage, and minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches, unless otherwise indicated.

D. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch, 16-gage, uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
2. Steel Studs and Runners: ASTM C 645.
   a. Minimum Base-Metal Thickness: 0.018 inch, 25-gage, unless otherwise indicated.
   b. Depth: As indicated on Drawings.

3. Embossed Steel Studs and Runners: ASTM C 645.
   a. Minimum Base-Metal Thickness: 0.0150 inch, 25-gage equivalent.
   b. Depth: As indicated on Drawings.

4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

   a. Minimum Base-Metal Thickness: 0.033 inch, 20-gage.

E. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Armstrong World Industries, Inc.; Drywall Grid Systems.
   b. Chicago Metallic Corporation; Drywall Grid System.
   c. United States Gypsum Company; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where

offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.

2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated on Drawings, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Furring Members:

1. Erect insulation, specified in Section 07 21 00 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 24 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.
3. Sound attenuation blankets for installation in gypsum baord assemblies such as walls and partitions.

B. Related Requirements:

1. Section 06 16 00 "Sheathing" for glass-mat gypsum sheathing for exterior walls.
2. Section 07 92 19 “Acoustical Joint Sealants” for sealants used at sound-rated partitions.
3. Section 09 21 16.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
4. Section 09 22 16 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.
2. For adhesives used on the interior of the building to laminate gypsum board panels to substrates, documentation including printed statement of VOC content in g/L.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates:

1. For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project and fraction by weight that is considered regional.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

C. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.

2. Continental Building Products, LLC.
3. Georgia-Pacific Building Products.
4. National Gypsum Company.
5. United States Gypsum Company.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
4. Locations: Walls and ceilings of bathrooms with showers, and janitors closets.

2.4 SPECIALTY GYPSUM BOARD

A. Abuse-Resistant Gypsum Board: ASTM C 1629.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Continental Building Products, LLC; Protecta AR 100 Type X with Mold Defense.
b. National Gypsum Company; Gold Bond Hi-Abuse XP.
c. United States Gypsum Company; SHEETROCK Brand Mold Tough AR FIRECODE Core Panels.

2. Impact Resistance Classification Levels:

a. Surface Abrasion: Level 2 (minimum).
b. Indentation Resistance: Level 1.
c. Soft Body Impact Resistance: Level 2.
d. Hard Body Impact Resistance: Level 1.

3. Core: 5/8 inch, Type X.
4. Long Edges: Tapered.
5. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B. Impact-Resistant Gypsum Board: ASTM C 1629.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Continental Building Products, LLC; Protecta HIR 300 Type X with Mold Defense.
b. National Gypsum Company; Gold Bond Hi-Impact XP.
c. United States Gypsum Company; SHEETROCK Brand Mold Tough VHI FIRECODE Core Panels.

2. Impact Resistance Classification Levels:

a. Surface Abrasion: Level 2 (minimum).
b. Indentation Resistance: Level 1.
c. Soft Body Impact Resistance: Level 3.

d. Hard Body Impact Resistance: Level 3.

3. Core: 5/8 inch, Type X.
4. Long Edges: Tapered.
5. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corporation; FiberCement BackerBoard.
b. Custom Building Products; Wonderboard.
c. National Gypsum Company; PermaBase BRAND Cement Board.
d. United States Gypsum Company; DUROCK Cement Board.

2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. L-Bead: L-shaped; exposed long flange receives joint compound.
d. Expansion (control) joint.
e. Curved-Edge Cornerbead: With notched or flexible flanges.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive used on the interior of the building (defined as inside the weatherproofing system and applied on-site) shall comply with South Coast Air Quality Management District (SCAQMD) Rule #1168, effective date of July 1, 2005, and rule amendment date of January 7, 2005, and shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members 0.033 inch, 20 gage, thick or greater.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Sustainability Requirements: Provide sound attenuation blankets as follows:

a. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde, GREENGUARD Gold Certification.
b. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde, GREENGUARD Certification.
c. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

E. Acoustical Joint Sealant: As specified in Section 07 92 19 “Acoustical Joint Sealants.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8 inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2 inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Where required for fire-resistance-rated assembly.
2. Moisture- and Mold-Resistant Type: Walls and ceilings of bathrooms with showers, and janitors closets.
3. Abuse-Resistant Type: As indicated on Drawings.
4. Impact-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally or vertically unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

1. Control joints shall be installed where a wall or partition runs in an uninterrupted straight plane exceeding 30 linear feet.
2. Control joints in interior ceilings with perimeter relief shall be installed so that linear dimensions between control joints do not exceed 50 feet and total area between control joints does not exceed 2500 sq. ft.
3. Control joints in interior ceilings without perimeter relief shall be installed so that linear dimensions between control joints do not exceed 30 feet and total area between control joints does not exceed 900 sq. ft.
4. Control joints in exterior ceilings and soffits shall be installed so that linear dimensions between control joints do not exceed 30 feet and total area between control joints does not exceed 900 sq. ft.
5. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.
6. Where a control joint occurs in an acoustical or fire-rated system, blocking shall be provided behind the control joint by using a backing material such as 5/8 inch type X gypsum board, mineral fiber, or other tested equivalent.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. Curved-Edge Cornerbead: Use at curved openings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Not used.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

5. Level 5: Not used.

E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 IDENTIFICATION OF INTERIOR FIRE- AND SMOKE-RATED WALLS AND PARTITIONS

A. Markings and Identification: Refer to requirements specified in Section 09 91 23 “Interior Painting.”

3.8 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 30 13

TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Glazed wall tile.
2. Stone thresholds.

B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 09 29 00 "Gypsum Board" for cementitious backer units.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. For adhesives used on the interior of the building, include a statement of VOC content in g/L.
2. For grout sealers, include documentation indicating that products comply with requirements of FloorScore certification.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:

1. Each type and composition of tile and for each color and finish required.
2. Metal edge strips.

1.5 INFORMATIONAL SUBMITTALS

A. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Stone thresholds.
2. Waterproof membrane.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

A. Glazed Ceramic wall tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Marazzi Tile, Inc.
b. American Olean; a division of Dal-Tile Corporation.
c. Daltile.
d. Grupo Porcelanite.
e. Jeffrey Court Inc.
f. Seneca Tiles, Inc.

2. Module Size: 4-1/4 by 4-1/4 inches.
3. Face Size Variation: Rectified.
4. Thickness: 5/16 inch.
5. Face: Plain with modified square edges.
6. Finish: Bright, clear glaze.
7. Tile Color and Pattern: As indicated on Drawings by manufacturer's designations or, if not indicated, as selected by Architect from manufacturer's full range.
8. Grout Color: As selected by Architect from manufacturer's full range.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

a. Base for Thinset Mortar Installations: Straight, module size 4-1/4 by 4-1/4 inches.

b. External Corners for Thinset Mortar Installations: Surface bullnose, same size as adjoining flat tile.
c. Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 10 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.5 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thinset): ANSI A118.11.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ardex GmbH.
b. Boiardi Products Corporation; a QEP company.
c. Bonsal American; an Oldcastle company.
d. Bostik, Inc.
e. C-Cure.
f. Custom Building Products.
g. Jamo Inc.
h. Laticrete International, Inc.
i. MAPEI Corporation.
j. Merkrete by Parex USA, Inc.
k. Southern Grouts & Mortars, Inc.
l. Summitville Tiles, Inc.
m. TEC; H. B. Fuller Construction Products Inc.

2. For wall applications, provide nonsagging mortar.

2.6 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Laticrete International, Inc.; SpectraLock Pro.
b. MAPEI Corporation; Kerapoxy CQ.
c. Merkrete by Parex USA, Inc.; Pro Epoxy.

2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

3. Colors: To be selected by Architect from manufacturer’s full range.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

C. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bonsal American, an Oldcastle company; Grout Sealer.
b. Custom Building Products; Grout Sealer.
c. MAPEI Corporation; UltraCare Grout Sealer.
d. Southern Grouts & Mortars, Inc.; Grout Sealer.
e. Summitville Tiles, Inc.; SL-15, Invisible Seal.
f. TEC, H. B. Fuller Construction Products Inc.; Guard All Invisible Penetrating Sealer.

2. Grout sealers used in the building interior must meet requirements of the FloorScore Standard (current as of the date of the LEED rating system, or more stringent version) as shown with testing by an independent third party.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the

use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the manufacturer's recommended joint widths.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

H. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. Do not extend waterproofing under thresholds set in latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on waterproofing with elastomeric sealant.

I. Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.5 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Wall Installations, Wood or Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W244C; thinset mortar on cementitious backer units.

a. Ceramic Tile Type: CT-1.
b. Thinset Mortar: Medium-bed, latex- cement mortar.
c. Grout: Water-cleanable epoxy grout.

B. Interior Wall Installations, Concrete block:

1. Ceramic Tile Installation: TCNA W2021-13; thinset mortar.

a. Ceramic Tile Type: CT-1.
b. Thinset Mortar: Medium-bed, latex- cement mortar.
c. Grout: Water-cleanable epoxy grout.

END OF SECTION 09 30 13

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.

B. Related Requirements:

1. Section 07 92 19 “Acoustical Joint Sealants” for acoustical joint sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.
2. For sealants used on the interior of the building, include a statement of VOC content in g/L.

B. Samples: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 15 percent.

C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

D. Acoustical Panel Standard: Comply with ASTM E 1264.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

2.3 ACOUSTICAL PANELS – ACT-1

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Fine Fissured Square Lay-In 1714 or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.
4. United States Gypsum Company.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
2. Pattern: C E

C. Color: White.

D. LR: Not less than 0.85.

E. NRC: Not less than 0.70.

F. CAC: Not less than 40.

G. Edge/Joint Detail: Square Lay-In.

H. Thickness: 3/4 inch.

I. Modular Size: As indicated on Drawings.

J. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 ACOUSTICAL PANELS- ACT-2

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Kitchen Zone 672 or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.
4. United States Gypsum Company.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type IX, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face.
2. Pattern: G.

C. Color: White.

D. LR: Not less than 0.89

E. CAC: Not less than 33.

F. Edge/Joint Detail: Square Lay-In.

G. Thickness: 5/8 inch.

H. Modular Size: 24 by 48 inches.

I. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
4. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

2.6 METAL SUSPENSION SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Prelude XL 15/16 Inch Exposed Tee System or comparable product by one of the following:

1. CertainTeed Corporation.
2. Chicago Metallic Corporation.
3. United States Gypsum Company.

2.7 METAL EDGE MOLDINGS AND TRIM

A. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:

1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for Alloy and Temper 6063-T5.
2. Basis-of-Design Product: Armstrong World Industries, Inc.; Axiom Trim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant specified in Section 07 92 19 “Acoustical Joint Sealants” in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient stair accessories.
3. Resilient molding accessories.

B. Related Requirements:
1. Section 09 65 19 "Resilient Tile Flooring" for resilient floor tile.
2. Section 09 68 13 "Tile Carpeting" for carpet tile with which wall base, reducer strips, caps, etc., will be installed.
3. Section 09 68 16 "Sheet Carpeting" for carpet with which wall base, reducer strips, caps, etc., will be installed.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. For adhesives used on the interior of the building, include a statement of VOC content in g/L.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. FloorScore Compliance: Resilient base and stair accessories installed in the building interior must meet the requirements of the FloorScore Standard (current as of the date of the LEED rating system, or more stringent version) as shown with testing by an independent third party.

2.2 THERMOPLASTIC-RUBBER BASE

A. Basis-of-Design Product: Subject to compliance with requirements, provide Johnsonite, A Tarkett Company; BaseWorks Thermoset Rubber Wall Base or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. Roppe Corporation, USA.

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style and Location:
   a. Style B, Cove.

C. Thickness: 0.125 inch.

D. Height: 4 inches unless otherwise indicated.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: As indicated on Drawings by manufacturer's designations.

2.3 RUBBER STAIR ACCESSORIES

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Johnsonite; Visually Impaired Rubber Stair Treads without Integrated Riser or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products, Division of Burke Industries Inc.
3. Flexco.
4. Mondo Rubber International, Inc.
5. R.C.A. Rubber Company (The).
6. Roppe Corporation, USA.

C. Stair Treads: ASTM F 2169.

1. Type: TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic).
2. Class: 2 (pattern; embossed, grooved, or ribbed).
3. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
4. Nosing Height: 2-3/16 inches.
5. Thickness: 1/4 inch and tapered to back edge.
6. Size: Lengths and depths to fit each stair tread in one piece.
7. Integral Risers: Smooth, flat; in height that fully covers substrate.

D. Locations: At both interior stairwells.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 RUBBER MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Roppe Corporation, USA.
2. VPI, LLC, Floor Products Division.

B. Description: Rubber transition strips or reducer strips as required.

C. Profile and Dimensions: As selected by Architect from Manufacturer's Full Range.

D. Locations: As required to provide transitions between adjacent floor finishes.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Installation adhesives for resilient materials used on the interior of the building shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.

1. Apply three coats.

E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 19

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Vinyl composition floor tile.

B. Related Requirements:

   1. Section 09 65 13 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

   1. For adhesives used on the interior of the building, include a statement of VOC content in g/L.
   2. For resilient tile flooring installed in the building interior, include documentation from an independent testing agency indicating compliance with the FloorScore Standard.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

   1. Show details of special patterns.

C. Samples: Full-size units of each color and pattern of floor tile required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. FloorScore Compliance: Resilient tile flooring installed in the building interior must meet requirements of the FloorScore Standard (current as of the date of the LEED rating system, or more stringent version) as shown with testing by an independent third party.

2.2 VINYL COMPOSITION FLOOR TILE VCT-1, VCT-2

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. Congoleum Corporation.
3. Mannington Mills, Inc.
4. Tarkett, Inc.

B. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch.

E. Size: 12 by 12 inches.

F. Colors and Patterns: As indicated on Drawings by manufacturer's designations.

2.3 LINEAR VINYL PLANK LVT-1

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. Congoleum Corporation.
3. Mannington Mills, Inc.
4. Tarkett, Inc.

B. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch.

E. Size: 36 by 6 inches.

F. Colors and Patterns: As indicated on Drawings by manufacturer's designations.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

1. Adhesives used for the installation of resilient tile flooring products on the interior of the building (i.e., inside the weatherproofing systems and applied on-site) must comply with the requirements of South Coast Air Quality Management District (SCAQMD) Rule #1168 effective date of July 1, 2005, and rule amendment date of January 7, 2005, and shall comply with the following limits for VOC content:

    a. Vinyl Composition Tile Adhesives: 50 g/L or less.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply three coats.

E. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 67 23

RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes resinous flooring systems.

B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for sealants installed at joints in resinous flooring systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including the following:

1. For liquid-applied flooring components, documentation including printed statement of VOC content in g/L.

B. Samples: For each type of exposed finish required.

C. Product Schedule: For resinous flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each resinous flooring component, from manufacturer.

B. Material Test Reports: For each resinous flooring system.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer.

Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Crossfield Products Corp.; Dex-O-Tex.
2. PalmaLite.
3. Sherwin-Williams Company; General Polymers.
4. Stonhard, Inc.

2.2 MATERIALS

A. VOC Content of Liquid-Applied Flooring Components: All floor coatings used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) must not exceed the VOC content limits established in South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings, rules in effect on January 1, 2004 and as follows:

1. VOC Content Limit: Not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 RESINOUS FLOORING

A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, decorative-aggregate-filled, epoxy-resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base.

B. System Characteristics:

1. Color and Pattern: As selected by Architect from manufacturer's full range.

2. Wearing Surface: Textured for slip resistance.
3. Overall System Thickness: 1/8 inch.

C. Body Coats:

1. Resin: Epoxy.
2. Formulation Description: 100 percent solids.
3. Application Method: Self-leveling slurry with broadcast aggregates.
4. Aggregates: Colored quartz (ceramic-coated silica).

D. Topcoat: Sealing or finish coats.

1. Resin: Epoxy.
2. Type: Clear.
3. Finish: Matte.

E. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Compressive Strength: 6,000 PSI per ASTM C 579.
2. Tensile Strength: 1,500 PSI per ASTM C 307.
3. Flexural Modulus of Elasticity: 500,000 PSI per ASTM C 580.
4. Water Absorption: 1.0% maximum per ASTM C 413.
5. Coefficient of Thermal Expansion: 40x10-6 in./in. deg F per ASTM C 531.
6. Indentation: 7% percent maximum per MIL-D-3134.
7. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation per MIL-D-3134.
8. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch per MIL-D-3134.
9. Flammability: Self-extinguishing per ASTM D 635.
10. Hardness: 83-90, Shore D per ASTM D 2240.
11. Bond Strength: 175 PSI, 100 percent concrete failure per ACI 503R.

2.4 ACCESSORIES

A. Primer: Type recommended by manufacturer for substrate and body coats indicated.

B. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

C. Cove Base: Apply cove base after primer/membrane bodycoat. Apply to height of 6 inches. Follow formulator’s detailed application instructions covering taping, mixing, priming, troweling, sanding and topcoating of cove base.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

a. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.

3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours.
b. Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
c. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.2 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply reinforcing membrane to substrate cracks.

D. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

1. Integral Cove Base: 6 inches high.

E. Apply self-leveling slurry body coats in thickness indicated for flooring system.

1. Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.

F. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 23

SECTION 09 68 13

TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes modular, carpet tile.

B. Related Requirements:
1. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
2. Section 09 68 16 "Sheet Carpeting."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include installation recommendations for each type of substrate.
3. For installation adhesive used on the interior of the building, include a statement of VOC content in g/L.
4. For carpet tile installed in the building interior, indicate compliance with testing and product requirements of the Carpet and Rug Institute’s (CRI's) "Green Label Plus" program.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of installation.
4. Pattern of installation.
5. Pattern type, location, and direction.
6. Type, color, and location of insets and borders.
7. Type, color, and location of edge, transition, and other accessory strips.
8. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with the CRI Carpet Installation Standard, latest edition.

1.9 FIELD CONDITIONS

A. Comply with the CRI Carpet Installation Standard, latest edition, for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
3. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE CPT-1

A. Products: Subject to compliance with requirements, provide the following:

1. Shaw Floors; Capital III.

B. Color: 80572 Governor.

C. Fiber Type: 100% Nylon.

D. Backing System: Ecoworx.

E. Size: 24 by 24 inches.

F. Applied Soil-Resistance Treatment: Manufacturer's standard material.

G. Antimicrobial Treatment: Manufacturer's standard material.

H. Performance Characteristics: As follows:
1. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
2. Emissions: All carpet tile products installed in the building interior must meet the testing and product requirements of CRI's "Green Label Plus" program.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. Indoor carpet adhesives used on the interior of the building (i.e., inside the weatherproofing systems and applied on-site) must comply with the requirements of South Coast Air Quality Management District (SCAQMD) Rule #1168 effective date of July 1, 2005, and rule amendment date of January 7, 2005, and shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
4. Testing of Concrete Substrates:

    a. Comply with the CRI Carpet Installation Standard, Section 9.0, “Testing Concrete Substrates.”
    b. Moisture Testing: Proceed with installation only after substrates pass testing according to carpet and with carpet cushion manufacturers’ written recommendations, but not less stringent than the following:

        1) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
        2) Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

    c. Alkalinity and Adhesion Testing: Perform tests according to ASTM F 710. Proceed with installation only if substrate alkalinity does not exceed 9 pH.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the CRI Carpet Installation Standard, latest edition, and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks,

holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the CRI Carpet Installation Standard, Section 18, "Modular Carpet," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with the CRI Carpet Installation Standard, Section 20, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 68 16

SHEET CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes tufted carpet.

B. Related Requirements:

1. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.
2. Section 09 68 13 "Tile Carpeting."

1.3 ACTION SUBMITTALS

A. Product Data: For the following, including installation recommendations for each type of substrate:

1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. For adhesives used on the interior of the building, include a statement of VOC content in g/L.
3. For carpet installed in the building interior, indicate compliance with testing and product requirements of the Carpet and Rug Institute’s (CRI's) "Green Label Plus" program.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Seam locations, types, and methods.
4. Pattern type, repeat size, location, direction, and starting point.
5. Type, color, and location of edge, transition, and other accessory strips.
6. Transition details to other flooring materials.

C. Samples: For each exposed product and for each color and texture specified.

1. Carpet: 12-inch- square Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: For carpet, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced Installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet identical to those of assemblies tested for fire response per NFPA 253 by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with the CRI Carpet Installation Standard, latest edition.

1.9 FIELD CONDITIONS

A. Comply with the CRI Carpet Installation Standard, latest edition, for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.10 WARRANTY

A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.
3. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUFTED CARPET CPT-2

A. Products: Subject to compliance with requirements, provide the following:

1. Shaw Contract Group; Potential III.

B. Color: 88522 Credible.

C. Fiber Type: Solution q nylon.

D. Pile Thickness: 0.128 inches for finished carpet.

E. Stitches: 9 stitches per inch.

F. Gage: 1/8.

G. Backing System: ClassicBac.

H. Width: 12 feet.

I. Applied Soil-Resistance Treatment: SSP Shaw Soil Protection.

J. Antimicrobial Treatment: Manufacturer's standard material.

K. Performance Characteristics: As follows:

1. Electrostatic Propensity: Less than 3.5 kV per AATCC 134.
2. Emissions: All carpet products installed in the building interior must meet the testing and product requirements of CRI's "Green Label Plus" program.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

1. Carpet adhesives used on the interior of the building (i.e., inside the weatherproofing systems and applied on-site) must comply with the requirements of South Coast Air Quality Management District (SCAQMD) Rule #1168 effective date of July 1, 2005, and rule amendment date of January 7, 2005, and shall have a VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
2. Subfloor finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" for slabs receiving carpet.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
4. Testing of Concrete Substrates:

    a. Comply with the CRI Carpet Installation Standard, Section 9.0, “Testing Concrete Substrates.”
    b. Moisture Testing: Proceed with installation only after substrates pass testing according to carpet and with carpet cushion manufacturers’ written recommendations, but not less stringent than the following:

        1) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
        2) Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

    c. Alkalinity and Adhesion Testing: Perform tests according to ASTM F 710. Proceed with installation only if substrate alkalinity does not exceed 9 pH.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the CRI Carpet Installation Standard, latest edition, and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with the CRI Carpet Installation Standard, latest edition, and carpet manufacturer's written installation instructions for the following:

1. Direct-Glue-Down Installation: Comply with the CRI Carpet Installation Standard, Section 13 "Direct Glue-Down Installation."
2. Stair Installation: Comply with the CRI Carpet Installation Standard, Section 17, "Carpet on Stairs" for glue-down installation.

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Do not bridge building expansion joints with carpet.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with the CRI Carpet Installation Standard, Section 20, "Protecting Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION 09 68 16

SECTION 09 84 33

SOUND-ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes shop-fabricated, sound-absorbing wall panel units tested for acoustical performance.

1.3 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including the following:

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.
2. Include a statement of VOC content in g/L.

B. Shop Drawings: For sound-absorbing wall units. Include mounting devices and details.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of sound-absorbing wall unit, from manufacturer.

B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound-absorbing wall units to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain sound-absorbing wall units from single source from single manufacturer.

B. Fire-Test-Response Characteristics: Provide sound-absorbing wall units meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with sound-absorbing wall unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install sound-absorbing wall units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Air-Quality Limitations: Protect sound-absorbing wall units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-absorbing wall units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to the following:

a. Acoustical performance.
b. Warping of core.

2. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOUND-ABSORBING WALL UNITS

A. Sound-Absorbing Wall Panel: Manufacturer's standard panel construction .

1. Basis-of-Design Product: Tectum Inc; Direct-Attached Ceiling Panels.

2. Mounting: Match Tectum mounting type C-40: 1 ½" aluminum hat channels and R-8 batt insulation between hat channels.
3. Core: Manufacturer's standard.
4. Finish: Factory painted white.
5. Edge Profile: Beveled.
6. Reveals between Panels: Flush reveals.
7. Acoustical Performance: Sound absorption NRC of not less than 0.95 according to ASTM C 423 for Type C-40 mounting according to ASTM E 795.
8. Nominal Overall Panel Thickness: 1-1/2 inches.
9. Locations: Where indicated on Drawings.

2.2 FABRICATION

A. General: Use manufacturer's standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated units, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of sound-absorbing wall units.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sound-absorbing wall units in locations indicated on Drawings with vertical surfaces and edges plumb, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with sound-absorbing wall unit manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch.

B. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.4 CLEANING

A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 84 33

SECTION 09 91 13

EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Exposed galvanized metal (loose steel lintels, railings, etc.).

B. Related Requirements:
1. Section 09 91 23 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
2. Section 09 96 00 "High-Performance Coatings" for special-use coatings of exterior architecturally exposed structural-steel (AESS).

1.3 DEFINITIONS

A. MPI Gloss Level 1 (Matte or Flat finish): Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 3 (Eggshell finish): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 4 (Satin finish): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 5 (Semi-Gloss finish): 35 to 70 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 6 (Gloss finish): 70 to 85 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 7 (High-Gloss finish): More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product including the following:

1. Indicate VOC content in g/L.

B. Samples: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: For each product indicated. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Behr Process Corporation.
2. Benjamin Moore & Co.
3. PPG Architectural Finishes, Inc.
4. Pratt & Lambert.
5. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

D. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

1. Galvanized-metal substrates shall not be chromate passivated if primers are field applied.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Galvanized-Metal Substrates:

1. Latex System (Semi-Gloss):

a. Prime Coat: Primer, galvanized, water based, MPI #134.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

END OF SECTION 09 91 13

SECTION 09 91 23

INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Cement board.
2. Concrete masonry units (CMUs).
3. Steel and iron.
4. Galvanized metal.
5. Gypsum board.
6. Cotton or canvas insulation covering.

B. Related Requirements:

1. Division 05 Specifications for shop priming structural steel, steel joists, and steel decking.
2. Section 09 91 13 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
3. Section 09 96 00 "High-Performance Coatings" for special-use coatings of exterior architecturally exposed structural-steel (AESS).

1.3 DEFINITIONS

A. MPI Gloss Level 1 (Matte or Flat finish): Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 2 (Velvet finish): Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 3 (Eggshell finish): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 4 (Satin finish): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. MPI Gloss Level 5 (Semi-Gloss finish): 35 to 70 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 6 (Gloss finish): 70 to 85 units at 60 degrees, according to ASTM D 523.

G. MPI Gloss Level 7 (High-Gloss finish): More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. For paint and coating products used on the interior of the building, include a statement of VOC content in g/L.

B. Samples: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: For each product indicated. Include printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Provide products by Sherwin-Williams Company (The), or comparable products by one of the following::

1. Behr Process Corporation.
2. Benjamin Moore & Co.
3. Duron, Inc.
4. M.A.B. Paints.
5. McCormick Paints.
6. PPG Architectural Finishes, Inc.
7. Pratt & Lambert.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. VOC Content: Paints and coatings used on the interior of the building (i.e. inside the weatherproofing system and applied on-site) must comply with the following criteria as applicable to the Project scope:

1. Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993, and the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Flat Paints and Coatings: 50 g/L.
b. Nonflat Paints and Coatings: 100 g/L.

2. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L established in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd edition, January 7, 1997.
3. Clear wood finishes, floor coatings, stains, primers, sealers, and shellacs applied to interior elements must not exceed the VOC content limits established for those coating types in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004 and the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Dry-Fog Coatings: 50g/L.
b. Primers, Sealers, and Undercoaters: 100 g/L.
c. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
d. Pretreatment Wash Primers: 420 g/L.
e. Floor Coatings: 50 g/L.
f. Shellacs, Clear: 730 g/L.
g. Shellacs, Pigmented: 550 g/L.

D. Colors: As indicated in the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Other items as directed by Architect.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 IDENTIFICATION OF INTERIOR FIRE- AND SMOKE-RATED WALLS AND PARTITIONS

A. Markings and Identification: Fire walls, fire barriers, fire partitions, smoke barriers, and smoke partitions, or any other wall required to have protected openings or penetrations, shall be effectively and permanently identified with signs or stenciling. Provide stenciled text on each side of walls and partitions in accessible spaces above suspended ceiling systems in order to indicate that the wall or partition construction is rated.

1. Text: “FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS” or other text as required by authorities having jurisdiction.

    a. Letter Height: Not less than 3 inches, with a minimum 3/8-inch stroke in a contrasting color.
    b. Location: Centered 12 inches above suspended ceiling system.
    c. Spacing: Located not less than 10 feet from the end of each wall and repeated at intervals not exceeding 10 feet measured horizontally along entire length of wall or partition.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Cement Board Substrates:

1. Epoxy System MPI INT 3.3E:

    a. Prime Coat: Epoxy, matching topcoat.
    b. Intermediate Coat: Epoxy, matching topcoat.
    c. Topcoat: Epoxy, gloss, MPI #77.

B. CMU Substrates:

1. Alkyd System MPI INT 4.2C:

    a. Block Filler: Block filler, latex, interior/exterior, MPI #4 X-Green.
    b. Intermediate Coat: Alkyd, interior, matching topcoat.
    c. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), MPI #47.

2. Epoxy System MPI INT 4.2G:

    a. Block Filler: Block filler, epoxy, MPI #116.
    b. Intermediate Coat: Epoxy, matching topcoat.
    c. Topcoat: Epoxy, gloss, MPI #77.

C. Steel Substrates:

1. Latex System, Alkyd Primer MPI INT 5.1Q:

a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54 X-Green.

2. Water-Based Dry-Fall System MPI INT 5.1C:

a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.
b. Topcoat: Dry fall, latex, flat, MPI #118.

D. Galvanized-Metal Substrates:

1. Water-Based Dry-Fall System MPI INT 5.3H:

a. Prime Coat: Dry fall, water based, for galvanized steel, matching topcoat.
b. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI Gloss Level 1), MPI #133.

E. Gypsum Board Substrates:

1. Latex over Latex Sealer System (Flat) MPI INT 9.2A:

a. Prime Coat: Primer sealer, latex, interior, MPI #50 X-Green.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #53 X-Green.

2. Latex over Latex Sealer System (Eggshell) MPI INT 9.2A:

a. Prime Coat: Primer sealer, latex, interior, MPI #50 X-Green.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior (MPI Gloss Level 3), MPI #52 X-Green.

3. Latex over Latex Sealer System (Semi-Gloss) MPI INT 9.2A:

a. Prime Coat: Primer sealer, latex, interior, MPI #50 X-Green.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54 X-Green.

F. Cotton or Canvas Insulation-Covering Substrates: Including pipe and duct coverings.

1. Latex System (Eggshell):

a. Prime Coat: Primer sealer, latex, interior.
b. Topcoat: Latex, interior (MPI Gloss Level 3).

END OF SECTION 09 91 23

SECTION 09 96 00

HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:

a. Architecturally exposed structural steel (AESS).

B. Related Requirements:

1. Section 05 12 00 “Structural Steel Framing” for shop priming of metal substrates with high-performance coatings specified in this Section.
2. Section 05 52 13 "Pipe and Tube Railings" for exterior steel railings to be shop finished with high-performance coatings specified in this Section.
3. Section 09 91 13 "Exterior Painting" for general field painting of exterior substrates.
4. Section 09 91 23 "Interior Painting" for general field painting of interior substrates.

1.3 DEFINITIONS

A. Terms “Paint” or “Painting” shall in a general sense have reference to sealers, primers, oil, alkyd, latex, polyurethane, epoxy, and enamel type coatings and application of these materials.

B. Dry Film Thickness (DFT): Thickness, measured in mils, of a coat of paint in cured state.

C. Refer to ASTM D16 for interpretation of terms used in this Section.

1.4 COORDINATION

A. Perform work in proper sequence with work of other trades to avoid damage to finished work. Where coatings are scheduled to be applied over shop applied coatings, coordinate work of such shop applied products to ensure compatibility with field applied coating systems.

1.5 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's literature describing products to be provided, giving manufacturer's name, product name, and product line number for each material. Submit technical data sheets for each coating, giving descriptive data, curing times, mixing, thinning,

and application requirements. Provide material analysis, including vehicle type and percentage by weight and by volume of vehicle, resin, and pigment.

B. Samples for Initial Selection: Submit color charts displaying manufacturer's full range of standard colors for initial selection by Architect.

1. Sample Size: Not less than 6 inches by 6 inches.

C. Product List: Submit a complete list of products proposed for use, including identifying product names and catalog numbers. Arrange in same format as Schedule of Paint Finishes are specified. Include applicable manufacturer's data and recommendations.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Company specializing in manufacture of high performance coatings with a minimum of 10 years experience. Materials shall be products of a single manufacturer or items standard with manufacturer of specified coating materials. Provide secondary materials which are produced or are specifically recommended by coating system manufacturer to ensure compatibility of system.

B. Installer’s Qualifications: Applicator shall be trained in application techniques and procedures of coating materials and shall demonstrate a minimum of 2 years successful experience in such application. Maintain, throughout duration of application, a crew of painters who are fully qualified to satisfy specified qualifications.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading: Deliver products in manufacturer's original unopened containers. Each container shall have manufacturer's label, intact and legible. Containers shall fully identify brand, type, grade, class, and other qualifying information used to describe contents. Include on label for each container:

1. Manufacturer's name.
2. Type of coating.
3. Manufacturer's stock number.
4. Color name and number.
5. Instructions for thinning, where applicable.

B. Store materials in a protected area, away from construction activities. Restrict storage area to paint materials and related equipment.

C. Maintain temperature in area of storage between 40 degrees F and 110 degrees F.

D. Comply with health and fire safety regulations.

E. Remove damaged materials from Project site.

1.8 FIELD CONDITIONS

A. Environmental Requirements: Apply coating materials under conditions required by manufacturer, however air temperature shall not be below 35 degrees F or above 110 degrees

F; relative humidity shall be no higher than 85 percent; and for exterior spray application, wind velocity shall be less than 15 mph.

B. Refer to specific product information sheets for minimum surface temperature requirements. Surface temperatures shall be at least 5 degrees F above dew point and in a rising mode.

C. Verify atmosphere is relatively free of airborne dust.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Exterior High-Performance Coating Schedule for the coating category indicated.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. Material Compatibility:

1. Materials for use within each coating system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a coating system, products shall be recommended in writing by topcoat manufacturers for use in coating system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

B. Regulatory Requirements: Comply with applicable codes and ordinances for flame, fuel, smoke, and volatile organic compound (VOC) ratings requirements for finishes at time of application.

1. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

C. Colors: As indicated in the Drawings.

2.3 ACCESSORIES

A. Coating Application Accessories: Provide application accessories as indicated in coating manufacturer's application instructions, including but not limited to cleaning agents, etching agents, cleaning cloths, sanding materials, and clean-up materials. Material not specifically identified, but needed for proper application, shall be of a quality not less than specified products.

2.4 MIXES

A. Mix materials according to manufacturer’s latest printed instructions paying particular attention to mixing times, thinning requirements and limitations and temperatures.

2.5 SHOP FINISHING

A. Surface Preparation: Clean surfaces of loose scale, rust, oil, dirt, and other foreign matter, immediately prior to priming. Surfaces to be coated shall be clean, dry, smooth, and free from dust and foreign matter which will adversely affect adhesion or appearance. Prior to application of primer, structural steel shall be prepared to receive coating system in compliance with Steel Structures Painting Council SP-6.

B. Shop Applied Coatings: Steel members shall be provided with one coat of shop primer. Application of first coat shall follow immediately after surface preparation and cleaning and within an eight hour working day. Cleaned areas not receiving first coat within an eight hour period shall be re-cleaned prior to application of first coat.

C. Apply materials at film thicknesses specified by methods recommended by manufacturer in compliance with SSPC PA-1. Allow each coat of paint to dry thoroughly before applying succeeding coats. Make finish topcoats smooth, uniform in color, and free of laps, runs, dry spray, over-spray, and skipped or missed areas. Environmental conditions shall be in compliance with coating manufacturer's printed instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which application of coating systems shall be performed for conditions that will adversely affect execution, permanence, or quality of coating system application.

1. Correct conditions detrimental to timely and proper execution of Work. Do not proceed until unsatisfactory conditions have been corrected.

B. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions and responsibility for satisfactory performance.

3.2 PREPARATION

A. Protection: Take precautionary measures to prevent fire hazards and spontaneous combustion. Remove empty containers from Project site. Place cotton waste, cloths and hazardous materials in containers, and remove from site daily. Provide drop cloths, shields, and other protective equipment. Protect elements surrounding work of this Section from damage or disfiguration. As Work proceeds, promptly remove spilled, splashed, or splattered materials from surfaces. During application of coating materials, post Wet Paint signs. During application of solvent-based materials, post No Smoking signs.

B. Surface Preparation:

1. General Requirements: Prior to application of primer, surfaces shall be prepared to receive specified coating system in compliance with manufacturer's recommendations and specifications of Steel Structures Painting Council. Clean surfaces of residual deposits of grease, scale, rust, oil, dirt, and other foreign matter, immediately prior to priming. Surfaces to be coated shall be clean, dry, smooth and free from dust and foreign matter which will adversely affect adhesion or appearance.

2. Ferrous Metal Surfaces: Clean structural steel and metal joist in the shop or prior to erection in accordance with SSPC-SP6 Commercial Sand Blast Cleaning. Surfaces shall be free of residual deposits of grease, rust, scale, dirt, dust, and oil prior to blasting.

    a. For shop primed surfaces, sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Field welds and touch-ups shall be prepared to conform to original surface preparation standards.
    b. Shop applied prime coatings which are damaged during transportation, construction, or installation shall be thoroughly cleaned and touched up in field. Use repair procedures which insure complete protection of adjacent primer. Repair methods and equipment may include wire brushing, hand or power tool cleaning, or dry air blast cleaning. In order to prevent injury to surrounding painted areas, blast cleaning may necessitate use of lower air pressure, small nozzle and abrasive particle sizes, short blast nozzle distance from surface, shielding and masking. If damage is too extensive to tough-up, item shall be re-cleaned and coated or painted.
    c. For surfaces not shop primed, surfaces shall be cleaned in compliance with specifications of Steel Structures Painting Council.

3. Lightweight Metals: Prepare surfaces in compliance with SSPC SP2 or SP3.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and using application method best suited for obtaining full, uniform coverage of surfaces to be coated.

B. Apply primer, intermediate, and finish coats to comply with wet and dry film thicknesses and spreading rates for each type of material as recommended by manufacturer. Application rates in excess of those recommended and fewer numbers of coats than specified shall not be accepted.

C. Number of coats specified shall be minimum number acceptable. Apply additional coats as needed to provide a smooth, even application. Closely adhere to re-coat times recommended by manufacturer. Allow each coat to dry thoroughly before applying next coat. Provide adequate ventilation for tank interior to carry off solvents during drying phase.

D. Employ only application equipment that is clean, properly adjusted, and in good working order, and of type recommended by coating manufacturer.

E. After surface preparation, interior weld seams shall be brush applied.

F. Make edges of paint adjoining other materials or colors sharp and clean, without overlapping.

G. Piping and Conduit Exposed to View: Finish in compliance with requirements for unprimed ferrous metal items. Use colors specified in ANSI Z13.1 and Z535.1.

3.4 REPAIR / RESTORATION

A. At completion of Work, touch-up and restore finishes where damaged.

B. Defects in Finished Surfaces: When stain, dirt, or undercoats show through final coat, correct defects, and cover with additional coats until coating is of uniform finish, color, appearance, and coverage. Correct defects visible from a distance of 5 feet. Runs shall not be permitted.

C. Touch-up of minor damage shall be acceptable where result is not visibly different from surrounding surfaces. Where result is visibly different, either in color, sheen, or texture, recoat entire surface.

3.5 MANUFACTURER'S FIELD SERVICE

A. Coatings manufacturer shall be available to provide on-site inspections, technical assistance, and guidance for application of coating system as needed.

3.6 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. Clean paint spots and other soiling from prefinished surfaces and surfaces with integral finish. Use solvents which will not damage finished surface.

C. Leave storage area clean and in same condition indicated for equivalent spaces in Project.

D. Protect work against damage until fully cured. Provide signs identifying wet surfaces until surfaces are adequately cured.

3.7 WASTE MANAGEMENT

A. Place materials defined as hazardous or toxic waste in designated containers.

B. Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal.

C. Do not dispose of paints or solvents by pouring on ground. Place in designated containers for proper disposal.

D. Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

3.8 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates: Exposed structural steel supporting exterior canopies.

1. Prime Coat: Aromatic urethane, zinc-rich, two-component, moisture-cured primer.

    a. Tnemec Company Incorporated; Tneme-Zinc Series 90-97 (2.5-3.5 mils DFT).

2. Intermediate Coat: Polyamide epoxy.

    a. Tnemec Company Incorporated; Hi-Build Epoxoline II Series N69 (2.0-3.0 mils DFT).

3. Topcoat: Thermoset solution fluoropolymer.

a. Tnemec Company Incorporated; Fluoronar Series 1071 Semi-Gloss (6.5-9.5 mils DFT).

END OF SECTION 09 96 00

DIVISION 10 – SPECIALTIES

10 11 00 Visual Display Units
10 14 19 Dimensional Letter Signage
10 14 23 Panel Signage
10 21 13.19 Plastic Toilet Compartments
10 21 23 Cubicle Curtains and Track
10 22 33 Accordion Folding Partitions
10 26 00 Wall and Door Protection
10 28 00 Toilet, Bath, and Laundry Accessories
10 44 13 Fire Protection Cabinets
10 44 16 Fire Extinguishers
10 51 13 Metal Lockers
10 55 00.13 USPS-Delivery Postal Specialties
10 73 43 Smoking Shelters
10 75 16 Ground-set Flagpoles

SECTION 10 11 00

VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Marker boards and tack boards.
2. Display rails.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
2. For adhesives used on the interior of the building, include a statement of VOC content in g/L.
3. For composite wood products used on the interior of the building, include documentation indicating that the product contains no added urea formaldehyde resins.

B. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work.
2. Show locations of panel joints.
3. Show locations and layout of special-purpose graphics.
4. Include sections of typical trim members.

C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of tackboards.

B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display units to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.8 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.
b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: Lifetime warranty.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

2.2 MARKER BOARD ASSEMBLY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Claridge Products and Equipment, Inc.
2. Ghent Manufacturing, Inc.
3. Steelcase PolyVision

B. Visual Display Board Assembly: Factory fabricated.

1. Assembly: Markerboard.
2. Corners: Square.
3. Width: As indicated on Drawings.

4. Height: As indicated on Drawings.
5. Mounting Method: Direct to wall.

C. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.

1. Color: White.

D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; standard size and shape.

1. Aluminum Finish: Clear anodic finish.

E. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

F. Marker tray: Manufacturer's standard; continuous.

1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

2.3 TACK BOARD ASSEMBLY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Claridge Products and Equipment, Inc.
2. Ghent Manufacturing, Inc.
3. Steelcase PolyVision

B. Visual Display Board Assembly: Factory fabricated.

1. Assembly: Tackboard.
2. Corners: Square.
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting Method: Direct to wall.

C. Tackboard Panel: Natural-cork tackboard panel on core indicated.

D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; standard size and shape.

1. Aluminum Finish: Clear anodic finish.

E. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

2.4 DISPLAY RAILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Claridge Products and Equipment, Inc.

2. Ghent Manufacturing, Inc.
3. Marsh Industries, Inc.

B. Aluminum Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork tackable insert,designed to hold accessories.

1. Aluminum Finish: Clear anodic finish.

C. Tackable Insert Color: As selected by Architect from full range of industry colors.

D. Size: 2 inches high by length indicated on Drawings.

E. End Stops: Aluminum.

F. Accessories:

1. Metal Map Hooks: Include two map hooks per 20 feet of installed display rail.

2.5 MARKERBOARD PANELS

A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with high-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.

1. Particleboard Core: 3/8 inch thick; with 0.015-inch- thick, aluminum sheet backing.
2. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.6 TACKBOARD PANELS

A. Tackboard Panels:

1. Facing: 1/4-inch- thick natural cork.
2. Core: 1/4-inch- thick particleboard.

2.7 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

B. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.

C. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no added urea formaldehyde resins.

D. Extruded Aluminum: ASTM B 221, Alloy 6063.

E. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

1. Adhesives used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with the requirements of South Coast Air Quality Management District (SCAQMD) Rule #1168 effective date of July 1, 2005, and rule amendment date of January 7, 2005, and shall have a VOC content of 50 g/L or less.

F. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 09 91 23 "Interior Painting" and recommended in writing by visual display unit manufacturer for intended substrate.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

E. Prepare recesses for sliding visual display units as required by type and size of unit.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.

C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.

1. Mounting Height: 36 inches above finished floor to top of marker tray.

D. Display Rails: Install rails at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at not more than 16 inches o.c.

1. Mounting Height: 72 inches above finished floor to top of rail.

3.4 CLEANING AND PROTECTION

A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 10 11 00

SECTION 10 14 19

DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes individually mounted, cast dimensional characters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dimensional letter signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ASI Sign Systems, Inc.
b. Gemini Incorporated.
c. Metal Arts.
d. Triangle Sign & Service.

2. Character Material: Cast aluminum.
3. Character Height: As indicated on Drawings.
4. Finishes:

a. Integral Aluminum Finish: Black anodized.

5. Mounting: Concealed studs, unless otherwise indicated.
6. Typeface: As indicated on Drawings.

2.2 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Sign Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Internally brace signs for stability and for securing fasteners.
5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

A. Black Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 19

SECTION 10 14 23

PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Panel signs.
2. Room-identification signs.

B. Related Requirements:
1. Section 01 50 00 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
2. Section 01 56 39 "Temporary Tree and Plant Protection" for temporary protection-zone signage.
3. Section 14 21 00 "Electric Traction Elevators" for code-required conveying equipment signage.
4. Section 22 05 53 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
5. Section 23 05 53 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
6. Division 26 specifications for labels, tags, and nameplates for electrical equipment.
7. Division 26 specifications for illuminated, self-luminous, and photoluminescent exit sign units.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

B. Samples: For each exposed product and for each color and texture specified.

C. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer's written installation instructions.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Three (3) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.2 SIGNS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 2/90 Sign Systems.
2. Allen Markings.
3. APCO Graphics, Inc.
4. ASI Sign Systems, Inc.
5. Best Sign Systems, Inc.
6. Innerface Architectural Signage, Inc.
7. Mohawk Sign Systems.

8. Poblocki Sign Company, LLC.
9. Seton Identification Products.
10. Stamprite Supersine.

B. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Solid-Sheet Sign: Acrylic sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph below and as follows:

a. Surface-Applied Graphics: Applied paint.
b. Etched and Filled Graphics: Sign face etched or routed to receive enamel-paint infill.
c. Inset, Cutout Characters: Sign face routed to receive push-through acrylic graphics.

2. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition, Vertical Edges , Horizontal Edges: Square cut.
b. Corner Condition in Elevation: Square.

3. Mounting: Surface mounted to wall with concealed anchors, unless otherwise indicated.

4. Text and Typeface: Accessible raised characters and Braille.

5. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.

C. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Laminated-Sheet Sign: Photopolymer or Sandblasted polymer face sheet with raised graphics laminated over subsurface graphics to acrylic backing sheet to produce composite sheet.

a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
b. Surface-Applied Graphics: Applied paint.
c. Subsurface Graphics: Slide-in changeable insert.
d. Color(s): As selected by Architect from manufacturer's full range.

2. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition: Square cut.
b. Corner Condition in Elevation: Square.

3. Mounting: Surface mounted to wall with concealed anchors, unless otherwise indicated.

4. Text and Typeface: Accessible raised characters and Braille.

2.3 PANEL-SIGN MATERIALS

A. Acrylic Sheet: ASTM D 4802, Type UVF (UV filtering).

B. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Internally brace signs for stability and for securing fasteners.
5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Furnish two blank inserts for each sign for Owner's use.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
   1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Install signs so they do not protrude or obstruct according to the accessibility standard.
   3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated and according to accessibility standard.

C. Mounting Methods:

   1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

      a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
      b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 23

SECTION 10 21 13.19

PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes solid-plastic toilet compartments configured as toilet enclosures and urinal screens.

B. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for blocking.
2. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachment details.

1. Show locations of cutouts for compartment-mounted toilet accessories.
2. Show locations of centerlines of toilet fixtures.

C. Samples for Selection: For each type of toilet compartment material indicated. Include Samples of hardware and accessories involving material and color selection.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Smoke-Developed Index: 450 or less.

B. Recycled Content of Solid-Plastic Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

C. Regulatory Requirements: Comply with applicable provisions in the 2010 ADA Standards and ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Scranton Products; Hiny Hiders or comparable product by one of the following:

1. Accurate Partitions Corp.; ASI Group.
2. American Sanitary Partition Company.
3. Bradley Corporation.
4. General Partitions Mfg. Corp.
5. Global Partitions; ASI Group.
6. Metpar Corp.

B. Toilet-Enclosure Style: Overhead braced.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.

1. Color and Pattern: As selected by Architect from manufacturer's full range.

E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.

F. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Stainless steel.
2. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.
3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide

units that comply with regulatory requirements for accessibility at compartments designated as accessible.

4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.

b. Panels and Walls: 1 inch.

2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13.19

SECTION 10 21 23

CUBICLE CURTAINS AND TRACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Curtain tracks and carriers.
2. Curtains.

B. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for supplementary wood framing and blocking for mounting items requiring anchorage.
2. Section 09 22 16 "Non-Structural Metal Framing" for supplementary metal framing and blocking for mounting items requiring anchorage.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include durability, laundry temperature limits, fade resistance, applied curtain treatment, and fire-test-response characteristics for each type of curtain fabric indicated.
2. Include data for each type of track.

B. Shop Drawings: Show layout of cubicles, sizes of curtains, number of carriers, anchorage details, and accessories.

1. Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
2. Include details on blocking above ceiling.

C. Samples: For each exposed product and for each color and texture specified, 10 inches in size.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For curtains, track, and hardware to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Curtains: Provide curtain fabrics with the following characteristics:

1. Launderable to a temperature of not less than 90 deg F.
2. Flame resistant and identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.

2.2 CURTAIN AND SUPPORT-SYSTEM MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A. R. Nelson Co.
2. ADC Hospital Equipment.
3. General Cubicle; C/S Construction Specialties.
4. Imperial Fastener Company, Inc.
5. InPro Corporation (IPC).
6. Pryor Products.
7. Salsbury Industries.

2.3 CURTAIN SUPPORT SYSTEMS

A. Extruded-Aluminum Curtain Track: Not less than 1-1/4 inches wide by 3/4 inch high; with 0.062-inch minimum wall thickness.

1. Curved Track: Factory-fabricated, 12-inch- radius bends.
2. Finish: Clear anodized.

B. Curtain Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.

1. Suspended-Track Support: Not less than 5/8-inch- square tube.
2. End Stop: Nonremovable.

C. Curtain Carriers: One-piece nylon glide with chrome-plated steel hook.

D. Exposed Fasteners: Stainless steel.

E. Concealed Fasteners: Hot-dip galvanized.

2.4 CURTAINS

A. Cubicle Curtain Fabric: Curtain manufacturer's standard, 100 percent polyester, inherently and permanently flame resistant, stain resistant, and antimicrobial.

1. Color and Pattern: As selected by Architect from manufacturer's full range.

B. Curtain Grommets: Nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.

C. Mesh Top: Not less than 20-inch- high mesh top of No. 50 nylon mesh.

D. Fabricate curtains as follows:

1. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches added fullness.
2. Length: Equal to floor-to-ceiling height, minus depth of track and carrier at top, and minus clearance above the finished floor as follows:

a. Cubicle Curtains: 15 inches.

3. Top Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lockstitched.
4. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, double thickness and single lockstitched.
5. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with double turned edges, and single lockstitched.

E. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install tracks level and plumb, according to manufacturer's written instructions.

B. Up to 20 feet in length, provide track fabricated from single, continuous length.

1. Curtain Track Mounting: As indicated on Drawings.

C. Suspended-Track Mounting: Install track with manufacturer's standard tubular aluminum suspended supports at intervals and with fasteners recommended by manufacturer. Fasten supports to structure. Provide supports at each splice and tangent point of each corner. Secure ends of track to wall with flanged fittings or brackets.

D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

E. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.

F. Curtains: Hang curtains on each curtain track.

END OF SECTION 10 21 23

SECTION 10 22 33

ACCORDION FOLDING PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated, accordion folding partitions.

B. Related Requirements:

1. Section 05 50 00 “Metal Fabrications” for steel framing and supports for operable partitions.
2. Section 06 10 53 "Miscellaneous Rough Carpentry" for supplementary wood framing and blocking for mounting items requiring anchorage.
3. Section 07 92 19 “Acoustical Joint Sealants” for sealants used at sound-rated partitions.

1.2 PERFORMANCE REQUIREMENTS

A. Acoustical Performance: Provide accordion folding partitions tested by a qualified testinga gency for the following acoustical properties according to test methods indicated:

1. Sound-Transmission Requirements: STC tested according to ASTM E 90 and calculated according to ASTM E 413.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Fire-Test-Response Characteristics: Provide partitions with finishes meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of accordion folding partitions that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCORDION FOLDING PARTITION

A. Accordion Folding Partition: Accordion folding frame with pantograph sections designed for horizontal extension and retraction, covered with decorative facing material, reinforced for hardware attachment, supported by overhead suspension system, and equipped with manufacturer's standard air-release method to prevent billowing.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Modernfold, Inc.; a DORMA Group Company; Soundmaster SM8 or comparable product by one of the following:

a. Hufcor.
b. Kwik-Wall.
c. Panelfold Inc.

B. Partition Type: As indicated on Drawings with the following hardware:

1. Lead Post Latching Hardware: Latch on both sides secured to surface jamb striker.
2. Lead Post Locking Hardware: Key-operated lock cylinder, keyed to master key system, operable from both sides of post.

C. STC Rating: Not less than 39.

D. Facing Material: Vinyl-Coated Fabric Wall Covering

1. Color/Pattern: As selected by Architect from manufacturer’s full range.

2.2 COMPONENTS

A. Posts and Seals: Provide types of posts and seals that produce accordion folding partitions complying with performance requirements.

1. Posts: Steel or aluminum; formed with deep-nesting and interlocking interfaces and fabricated to ensure rigidity of accordion folding partition.
2. Perimeter Seals: Manufacturer's standard vinyl, neoprene, or woven silica vertical seals, horizontal top and bottom seals, and closures for lead posts and jambs.

B. Hardware: Manufacturer's standard manually operated pulls, latches, locks, and bolts as required to operate accordion folding partitions; with decorative, protective finish.

2.3 SUSPENSION SYSTEMS

A. Suspension Tracks: Steel or aluminum designed for type of operation, size, and weight of accordion folding partition indicated. Size track to support partition operation and storage without damage to suspension system, accordion folding partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

1. Track: Surface mounted unless otherwise indicated; with factory-applied, decorative, protective finish.

B. Carriers: Trolley system as required for size and weight of partition and for easy, quiet operation; with ball-bearing carriers at lead post and ball-bearing carriers at intermediate panel supports.

C. Track Switches and Accessories: Manufacturer's standard switches as required for type of operation, storage, track configuration, and layout indicated.

D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

E. Steel Finish: Factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

2.4 FACING MATERIALS

A. General: Provide facing materials with appropriate backing that comply with indicated fire-test-response characteristics, and that are factory attached to accordion folding partitions with concealed fasteners.

1. Factory-apply facing material free of air bubbles, wrinkles, blisters, and other defects; in one-piece, seamless; and with no gaps or overlaps. Tightly secure and conceal raw and selvage edges of facing material for finished appearance. Horizontal butted edges or seams are not permitted.
2. Where facing material with directional or repeating pattern, directional weave, or matching grain is indicated, mark facing-material top and attach facing material in same direction.

B. Vinyl-Coated Fabric: Manufacturer's standard mildew-resistant, washable, vinyl-coated fabric wall covering; complying with CFFA-W-101-D for Type III; Class A.

2.5 ACCESSORIES

A. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, finish, construction, thickness, and acoustical qualities as panels; complete with operating hardware. Hinges in finish to match other exposed hardware.

1. Manufacturer's standard method to secure storage pocket door in closed position.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.

B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed.

C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

D. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

3.3 ADJUSTING

A. Adjust operable panel partitions to operate smoothly, without warping or binding. Lubricate hardware and other moving parts.

B. Adjust pass doors and storage pocket doors to operate smoothly and easily, without binding or warping. Check and readjust operating hardware. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.4 CLEANING

A. Clean soiled surfaces of operable panel partitions to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 10 65 10

SECTION 10 26 00

WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall guards.
2. Corner guards.

B. Related Requirements:

1. Section 08 71 00 "Door Hardware" for metal armor, kick, mop, and push plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including the following:

1. For adhesives used on the interior of the building, include a statement of VOC content in g/L.

B. Shop Drawings: For each impact-resistant wall protection unit. Include sections, details, and attachments to other work.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each impact-resistant plastic material, from manufacturer.

B. Material Test Reports: For each impact-resistant plastic material.

C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include

precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 01 40 00 "Quality Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Surface-Burning Characteristics: As determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

D. Regulatory Requirements: Comply with applicable provisions in the 2010 ADA Standards and ICC/ANSI A117.1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic sheet material out of direct sunlight.
3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store corner-guard covers in a vertical position.
b. Store wall-guard covers in a horizontal position.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of plastic and other materials beyond normal use.

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout.

1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
2. Chemical and Stain Resistance: Tested according to ASTM D 543.
3. Self-extinguishing when tested according to ASTM D 635.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.

B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.

C. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 for Alloy 6063-T5.

D. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

E. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer. All adhesives used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168, effective date of July 1, 2005 and rule amendment date of January 7, 2005, and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 CORNER GUARDS

A. Surface-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Floor Products Co., Inc.
b. Construction Specialties, Inc.
c. IPC Door and Wall Protection Systems; Division of InPro Corporation.
d. Korogard Wall Protection Systems; a division of RJF International Corporation.
e. Pawling Corporation.

2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; as follows:

   a. Profile: Nominal 2-inch- long leg and 1/4-inch corner radius.
   b. Height: 80 inches.
   c. Color and Texture: As selected by Architect from manufacturer's full range.

3. Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.3 IMPACT-RESISTANT WALL COVERINGS

A. Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Floor Products Co., Inc.
   b. Construction Specialties, Inc.
   c. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   d. Korogard Wall Protection Systems; a division of RJF International Corporation.
   e. Pawling Corporation.

2. Size: 48 by 96 inches for sheet.
3. Sheet Thickness: 0.060 inch.
4. Color and Texture: As selected by Architect from manufacturer's full range.
5. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
6. Mounting: Adhesive.

2.4 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

D. Miter corners and ends of wood handrails for returns.

E. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.
2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

a. Provide anchoring devices to withstand imposed loads.
b. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches.
c. Adjust top caps as required to ensure tight seams.

B. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00

SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Warm-air dryers.
4. Childcare accessories.
5. Underlavatory guards.
6. Custodial accessories.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser T-18:

1. Product: SCA Tork; 56TR.

B. Liquid-Soap Dispenser T-5:

1. Product: Derma Pro; 9034L.

C. Paper Towel Dispenser T-3:

1. Product: Von Drehle; VD8880.

D. Grab Bar Set T-6 and T-23:

1. Basis-of-Design Products: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, No. 4 finish (satin).

3. Outside Diameter: 1-1/2 inches.

E. Seat-Cover Dispenser:

1. Product: Sanitor USA; Neat Seat Dispenser FH33.
2. Mounting: Toilet partition mounted.
3. Exposed Material and Finish: ABS plastic, white or metal, factory-painted white.
4. Lockset: Tumbler type.
5. Location: Provide one at each water closet.

F. Mirror Unit T-4:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; Model B-165 or comparable product by one of the following:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Frame: Type 430 stainless steel with bright-polished finish.

a. Corners: Mitered.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using one of the following methods.

a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

4. Size: As indicated on Drawings.

2.3 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Shower Curtain Rod T-24:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

B. Grab Bar Set T-7:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, No. 4 finish (satin).

3. Outside Diameter: 1-1/2 inches.

C. Grab Bar Set T-8:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, No. 4 finish (satin).

3. Outside Diameter: 1-1/2 inches.

D. Folding Rectangular Shower Seat T-9:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley Corporation; Model 9562 or comparable product by one of the following:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Configuration: Rectangular-shaped seat, designed for wheelchair access.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin).
5. Dimensions: 28-1/2 inches wide by 15 inches deep.
6. Location: Provide at each wheelchair accessible roll-in-type shower stall.

E. Folding L-Shaped Shower Seat T-10:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley Corporation; Model 9569 or comparable product by one of the following:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.

d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Configuration: Reversible L-shaped seat, designed for wheelchair access Insert description.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin).
5. Dimensions: 34-1/2 inches wide by 22 inches deep.
6. Location: Provide at each wheelchair accessible transfer-type shower stall.

F. Fold-Up Bathtub Seat T-11:

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Specialties; Model 8358 or comparable product by one of the following:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Configuration: Rectangular-shaped seat, designed for wheelchair access.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin).
5. Dimensions: 33 inches wide by 15 inches deep.
6. Location: Provide at each bathtub.

G. Grab Bar Set T-12:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, No. 4 finish (satin).

3. Outside Diameter: 1-1/2 inches.

H. Robe Hook T-17:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.

e. GAMCO Specialty Accessories; a division of Bobrick.

2. Description: Double-prong unit.
3. Location: Provide at each shower and changing stall.

2.4 WARM-AIR DRYERS

A. High-Speed Warm-Air Dryer T-21:

1. Product: Product indicated on Drawings.
2. Description: High-speed, warm-air hand dryer for rapid hand drying.
3. Mounting: Surface mounted.
4. Operation: Electronic-sensor activated with operation time of 10 to 20 seconds.
5. Cover Material and Finish: Stainless steel, No. 4 finish (satin).
6. Electrical Requirements: Insert electrical requirements.

2.5 CHILDCARE ACCESSORIES

A. Diaper-Changing Station T-22:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

   a. American Specialties, Inc.
   b. Diaper Deck & Company, Inc.
   c. Foundations Children's Products.
   d. GAMCO Specialty Accessories; a division of Bobrick.
   e. Koala Kare Products.
   f. SafeStrap Company, Inc. (SSC, Inc.)

2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.

   a. Engineered to support minimum of 250-lb static load when opened.

3. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.

2.6 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Plumberex Specialty Products, Inc.
   b. Truebro by IPS Corporation.

2. Description: Insulating pipe covering for exposed supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.

a. Locations: Provide underlavatory guards at all exposed supply and drain piping assemblies under accessible lavatories, sinks, etc.

3. Material and Finish: Antimicrobial, molded plastic, white.

2.7 CUSTODIAL ACCESSORIES

A. Mop and Broom Holder:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; Model B-239 x 34 or comparable product by one of the following:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 34 inches.
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Location: All housekeeping closets.
7. Material and Finish: Stainless steel, No. 4 finish (satin).

a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.

2.8 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 10 28 00

SECTION 10 44 13

FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fire-protection cabinets for portable fire extinguishers.

B. Related Requirements:

1. Section 10 44 16 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; Model FS 2409-5R or comparable product by one of the following:

    a. JL Industries, Inc.; a division of the Activar Construction Products Group.
    b. Potter Roemer LLC.

B. Cabinet Construction: 1-hour fire rated.

1. Location: Within fire rated partitions.
2. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-, 18-gage, thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet.

D. Recessed Cabinet:

1. Location: Within walls of sufficient depth for recessed cabinets.
2. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Location: Within walls of insufficient depth for recessed cabinets but of sufficient depth to accommodate semirecessed cabinet installation.
2. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

F. Cabinet Trim Material: Same material and finish as door.

G. Door Material: Stainless-steel sheet.

H. Door Style: Fully glazed panel with frame.

I. Door Glazing: Tempered float glass (clear).

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer’s standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet glazing.
2) Application Process: Pressure-sensitive vinyl letters.
3) Lettering Color: As required by authorities having jurisdiction.
4) Orientation: Vertical.

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Provide doors and frames to receive locks.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed and semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated on Drawings or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 10 44 16

FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:

1. Section 10 44 13 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Indicate fire protection cabinet type and locations.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket location indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. JL Industries, Inc.; a division of the Activar Construction Products Group.
b. Larsens Manufacturing Company.
c. Potter Roemer LLC.

2. Valves: Manufacturer’s standard.
3. Handles and Levers: Manufacturer’s standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Wet-Chemical Type: UL-rated 2-A:1-B:C:K, 1.6-gal. nominal capacity, with potassium acetate-based chemical in stainless-steel container; with pressure-indicating gage.

1. Locations: Install on mounting brackets in kitchens and where indicated on Drawings.

C. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:80-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

1. Locations: Install in fire protection cabinets in corridors and where indicated on Drawings.

D. Carbon Dioxide Type: UL-rated 5-B:C, 5-lb nominal capacity, with carbon dioxide in manufacturer's standard enameled-metal container.

1. Locations: Install on mounting brackets in rooms with electrical equipment, elevator machine room, boiler room, mechanical rooms, electrical rooms, maintenance room, locations required by authorities having jurisdiction, and similar back-of-house spaces.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. JL Industries, Inc.; a division of the Activar Construction Products Group.
b. Larsens Manufacturing Company.
c. Potter Roemer LLC.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 10 51 13

METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Welded metal lockers.
2. Locker benches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of metal locker.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.

B. Shop Drawings: Include plans, elevations, sections, details, attachments to other work, and locker identification system and numbering sequence.

C. Samples for Selection: Manufacturer's color charts showing the full range of colors available.

1. Lockers.
2. Benches.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of latches or other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Welded Metal Lockers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain metal lockers, locker benches, and accessories from single source from single locker manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

2.3 WELDED METAL LOCKERS

A. Products: Subject to compliance with requirements, provide one of the following:

1. DeBourgh Mfg. Co.; Angle Iron Corridor.
2. Lyon Workspace Products, LLC; All-Welded.
3. Penco Products, Inc; All-Welded.
4. Republic Storage Systems, LLC; All-Welded Ventilated.

B. Doors: One piece; fabricated from 0.075-inch, 14-gage, nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
2. Door Style: Vented panel as follows:

a. Louvered Vents: No fewer than six louver openings at top and bottom for single-tier; no fewer than two louver openings at top and bottom for multi-tier lockers.

C. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Sides: 0.060-inch, 16-gage, nominal thickness.
2. Backs: 0.048-inch, 18-gage, nominal thickness.
3. Shelves: 0.060-inch, 16-gage, nominal thickness, with double bend at front and single bend at sides and back.

D. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.

E. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Continuous Hinges: Manufacturer’s standard, steel, full height.

F. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

1. Multipoint Latching: Finger-lift latch control designed for use with combination locks or padlocks; positive automatic latching.

a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.120-inch nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact.

G. Locks: Provide hasp for owner-supplied combination padlocks.

H. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

I. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

J. Continuous Sloping Tops: Fabricated from 0.048-inch, 18-gage, nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

1. Closures: Vertical-end type.

K. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.

L. Materials:

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

M. Finish: Baked enamel or powder coat.

1. Color: As selected by Architect from manufacturer's full range.

2.4 BENCHES

A. Provide bench units with overall assembly height of 18 inches.

B. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.

1. Size: Minimum 9-1/2 inches wide by 1-1/4 inches thick except provide minimum 20-inch-wide tops where accessible benches are indicated.
2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.

C. Fixed Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:

1. Tubular Steel: 1-1/2-inch- diameter steel tubing threaded on both ends, with standard pipe flange at top and bell-shaped cast-iron base; with baked-enamel or powder-coat finish; anchored with exposed fasteners.

a. Color: As selected by Architect from manufacturer's full range.

D. Materials:

1. Steel Tube: ASTM A 500/A 500 M, cold rolled.

2.5 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

C. Equipment: Provide each locker with an identification plate and the following equipment:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
2. Multi-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.

E. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.

2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

F. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.

G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

H. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

I. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

J. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.6 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.

2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
3. Anchor back-to-back metal lockers to floor.

B. Welded Lockers: Connect groups together with standard fasteners, with no exposed fasteners on face frames.

C. Equipment:

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach filler panels with concealed fasteners.
2. Attach sloping-top units to metal lockers, with closures at exposed ends.
3. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

E. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches apart.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 10 51 13

SECTION 10 55 00.13

USPS-DELIVERY POSTAL SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Mail receptacles.

B. Related Requirements:

1. Section 08 71 00 "Door Hardware" for lock cylinders for postal specialties that are keyed to building keying system and for letter slots in doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of postal specialty.

B. Shop Drawings: For postal specialties. Include plans, elevations, sections, and attachment details.

1. Include identification sequence for compartments.
2. Include layout of identification text.
3. Include setting drawings, templates, and installation instructions for anchor bolts and other anchorages installed as part of the Work of other Sections.

C. Samples: For units with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of postal specialty required to comply with USPS regulations, signed by product manufacturer. Include written approval by Postmaster General.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For postal specialties and finishes to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Furnish lock keys according to USPS requirements; with temporary identification for their respective locks, bagged, and securely taped inside the collection compartment for shipping.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of postal specialties that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MAIL RECEPTACLES

A. Front-Loading Mail Receptacles: USPS-STD-4C; consisting of multiple compartments with fixed, solid compartment backs, enclosed within a surface mounted wall box.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bommer Industries, Inc.
b. Florence Corporation; a Gibraltar Industries company.
c. Jensen Mailboxes; SCC Architectural Building Products.
d. Salsbury Industries.
e. Security Manufacturing Corporation.

2. Front-Loading Master Door: Fabricated from extruded aluminum and braced and framed to hold compartment doors; prepared to receive master-door lock.

a. Master-Door Lock: Door prepared to receive lock provided by local postmaster.

3. Compartments: Number and size as follows:

a. Type I: A group of mail receptacles in single-column configuration with single master door, one (1) mail compartment not less than 6 inches high by 12 inches wide by 15 inches deep, one outgoing mail collection compartment prepared for master-door lock, and one parcel-locker compartment 18 inches high by 12 inches wide by 15 inches deep.

4. Compartment Doors: Fabricated from extruded aluminum. Equip each with lock and tenant identification as required by USPS-STD-4C. Provide mail slot in the compartment with master-door lock.

a. Compartment-Door Locks: USPS-L-1172C; with three keys for each compartment door.
b. Parcel-Locker-Compartment-Door Locks: Two-key security system in which control key provides access to parcel-locker-compartment key, which opens compartment and is retained once opened.
c. Tenant Identification: 2-inch-wide by 5/8-inch- high, clear plastic cardholder set in recessed slot in face of compartment door. Provide cardboard strip and self-adhesive numbers.

5. Frames: Extruded aluminum or aluminum sheet; ganged and nested units, with cardholder and blank cards for tenant's identification within each compartment.

a. Provide cardboard identification tab with space for printing tenant name and apartment number.

6. Concealed Components and Mounting Frames: Aluminum or steel sheet.
7. Exposed Aluminum Finish:

a. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

2.2 FABRICATION

A. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs and safe to touch. Fabricate doors of postal specialties to preclude binding, warping, or misalignment.

B. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly.

C. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

D. Drill or punch holes required for fasteners and remove burrs. Use security fasteners where fasteners are exposed. If used, seal external rivets before finishing.

E. Weld in concealed locations to greatest extent possible without distorting or discoloring exposed surfaces. Remove weld spatter and welding oxides from exposed surfaces.

F. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support loads.

G. Where dissimilar metals contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturers of dissimilar metals.

2.3 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for roughing-in openings, clearances, and other conditions affecting performance of the Work.

B. Examine walls and other adjacent construction for suitable conditions before installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install postal specialties level and plumb, according to manufacturer's written instructions.

1. Where dissimilar metals contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturer.
2. Where aluminum contacts grout, concrete, masonry, or wood, protect against corrosion by painting contact surfaces with bituminous coating.
3. Final acceptance of postal specialties served by the USPS depends on compliance with USPS requirements.

B. Mail Receptacles: Install mail receptacles with center of tenant-door lock cylinders and bottom of compartments at the maximum and minimum heights above finished floor established by the USPS and manufacturer's written instructions.

1. Install removable-core and keyed-in door lock cylinders as required for each type of cylinder lock.

3.3 FIELD QUALITY CONTROL

A. Arrange for USPS personnel to examine and test postal specialties served by the USPS after they have been installed according to USPS regulations.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as postal specialties are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust doors, hardware, and moving parts to function smoothly, and lubricate as recommended by manufacturer. Verify that integral locking devices operate properly.

C. Touch up marred finishes or replace postal specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by postal-specialty manufacturer.

D. Replace postal specialties that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

E. On completion of postal-specialty installation, clean interior and exterior surfaces as recommended by manufacturer.

END OF SECTION 10 55 00.13

SECTION 10 73 43

SMOKING SHELTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Modular aluminum shelters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for shelters.

B. Shop Drawings: For shelters. Include plans, elevations, sections, details, and attachments to other work.

1. Anchor-Bolt Plans: Submit anchor-bolt plans and templates. Include location, diameter, and projection of anchor bolts required to attach shelters to concrete bases. Indicate post reactions at each location.

C. Samples: For each type of exposed finish.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For anchors, from ICC-ES.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shelters to include in maintenance manuals.

1.6 COORDINATION

A. Cast-in Anchorage: Coordinate installation of anchorages for shelters. Furnish sleeves, concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete bases. Include setting drawings, templates, and directions for installing anchorages. Deliver such items to Project site in time for installation.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair finish or replace shelters that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Shelters shall withstand the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:

1. Design Loads: As indicated on Drawings.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Safety Glazing Products: Category II materials complying with testing requirements in 16 CFR 1201.

2.2 MODULAR ALUMINUM SHELTERS

A. Fabricate shelters as an integrated set of modular components ready for assembly on Project site.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. AustinMohawk and Company, Inc.
b. Brasco International, Inc.
c. Duo-Gard Industries Inc.
d. Par-Kut International, Inc.
e. Tolar Manufacturing Company Inc.

B. Building Style: As indicated on Drawings.

1. Size: As indicated on Drawings.

C. Structural Framework: Fabricated from manufacturer's standard 2.5-inch x 2.5-inch x 0.125-inch aluminum tubing, channel, angle, or tee extrusions. Connect framework with exposed mechanical fasteners.

D. Post Bases: Externally adjustable, flanged, aluminum sleeves; minimum 3-inch vertical adjustment. Include shims for leveling.

E. Anchorage: Cast-in-place anchor bolts, fabricated from stainless steel, with allowable load or strength design capacities calculated to be greater than or equal to the design load.

F. Windows: Extruded-aluminum sash frames, factory glazed with polycarbonate glazing.

G. Roof: Flat with full perimeter gutter.

1. Exterior Roof Panels: Fabricated from 0.032-inch thick aluminum sheet with protective plastic sheet finish.
2. Canopy Fascia: Fabricated from 0.063-inch thick aluminum sheet, of manufacturer's standard design.

a. Height: 6 inches.
b. Overhang: 3 inches.

3. Downspouts: Integral, extending 3 inches beyond shelter walls.

H. Integral Bench: Aluminum bench.

1. Length: Partial length to allow wheelchair access.

I. Shelter Accessories:

1. Ashtray: Wall mounted, stainless steel.

J. Electrical Power Service: 125-A, 120/240-V ac, single phase, three wire. Run copper wiring in 1/2-inch EMT conduit. Exterior weatherproof connection box and lockable interior circuit breaker panel.

K. Lighting Fixtures: Activated by motion sensor.

1. Ceiling-mounted LED lighting.

L. Materials:

1. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

a. Sheet: ASTM B 209.
b. Extruded Shapes: ASTM B 221.

2. Polycarbonate Glazing: Thermoformable, extruded monolithic sheets, UV resistant, with anti-graffiti coating and with average impact strength of 12 to 16 ft-lb/in. of width when tested according to ASTM D 256, Test Method A (Izod).

   a. Color: Colorless, transparent.

M. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including concrete bases; accurate placement, pattern, and orientation of anchor bolts; critical dimensions; and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical system to verify actual locations of connections before shelter installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install shelters according to manufacturer's written instructions.

B. Set shelters plumb and aligned with full bearing on concrete bases.

C. Fasten shelters securely to concrete base with anchorage indicated.

D. Connect to electrical power.

3.3 ADJUSTING

A. After completing installation, inspect exposed finishes and repair damaged finishes.

END OF SECTION 10 73 43

SECTION 10 75 16

GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes ground-set flagpoles made from aluminum.

B. Owner-Furnished Material: Flags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.

1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is 90 mph.
2. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.3 ALUMINUM FLAGPOLES

A. Aluminum Flagpoles: Cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acme/Lingo Flagpoles LLC.
b. American Flagpole; a Kearney-National Inc. company.
c. Baartol Company.
d. Concord Industries, Inc.
e. Eder Flag Manufacturing Company, Inc.
f. Ewing Flagpoles.
g. Morgan-Francis Flagpoles and Accessories.
h. Pole-Tech Company Inc.
i. U.S. Flag & Flagpole Supply, LP.

B. Exposed Height: 30 feet.

C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

D. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch, 16 gage, wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch- diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.

1. Flashing Collar: Same material and finish as flagpole.

2.4 FITTINGS

A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.

1. 0.063-inch spun aluminum with gold anodic finish.

B. Finial Eagle: Sized as standard with manufacturer for flagpole size indicated.

1. Cast aluminum with gold anodic finish.

C. External Halyard: Ball-bearing, nonfouling, revolving truck assembly of cast metal with continuous 5/16-inch- diameter, braided polypropylene halyard and 9-inch cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.

1. Halyards and Cleats: One at each flagpole.
2. Cleat Covers: Cast metal, finished to match flagpole, secured with cylinder locks.
3. Halyard Flag Snaps: Chromium-plated bronze swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.

2.5 MISCELLANEOUS MATERIALS

A. Sand: ASTM C 33/C 33M, fine aggregate.

B. Elastomeric Joint Sealant: [Joint sealant complying with requirements in Section 07 92 00 "Joint Sealants."

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.6 ALUMINUM FINISHES

A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.

E. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.

F. Place concrete, as specified in Section 03 30 00 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

G. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where indicated and according to manufacturer's written instructions.

B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION 10 75 16

DIVISION 11 – EQUIPMENT

SECTION 11 31 00

APPLIANCES & EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Microwave ovens.
2. Refrigerators/freezers.
3. Dishwashers.
4. Clothes washers and dryers.
5. Audiology Booth.
6. Clinical equipment and accessories.

B. Related Requirements:

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. For appliances indicated, include documentation that products are ENERGY STAR rated.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each appliance to include in operation and maintenance manuals.

1.5 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace appliances or components that fail in materials or workmanship within specified warranty period except as qualified below:

1. Warranty Period: Two (2) years from date of Substantial Completion.

B. Refrigerator/Freezer, Sealed System: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on the product.

1. Warranty Period for Sealed Refrigeration System: Five (5) years from date of Substantial Completion.

C. Dishwasher: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on the product.

1. Warranty Period for Deterioration of Tub and Metal Door Liner: Ten (10) years from date of Substantial Completion.

D. Clothes Washer: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on the product.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Accessibility: Where appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design andICC A117.1.

2.2 MICROWAVE OVENS

A. Microwave Oven MW-01:

1. Basis-of-Design Product: Frigidaire; FFCE1439LW, or approved equal.
2. Capacity: 1.4 cu. ft..
3. Oven Door: Door with observation window and pushbutton latch release.
4. Microwave Power Rating: 1100 W.
5. Controls: Digital panel controls and timer display.
6. Other Features: Turntable.
7. Color/Finish: As selected by Architect from Manufacturer’s standard range.

2.3 REFRIGERATOR/FREEZERS

A. Refrigerator/Freezer REF-01: Two-door refrigerator/freezer with freezer on top and complying with AHAM HRF-1.

1. Product: Kenmore; 60502.
2. Color/Finish: As selected by Architect from Manufacturer’s standard range.

B. Refrigerator/Freezer REF-04: Vaccine refrigerator.

1. Product: TemPure Scientific; LP-48-HG-TP.

C. Refrigerator/Freezer REF-05: Vaccine refrigerator/freezer combo.

1. Product: TemPure Scientific; RF-9-TP.

D. Refrigerator/Freezer REF-06: Compact refrigerator.

1. Product: Kenmore; 70722.
2. Color/Finish: As selected by Architect from Manufacturer’s standard range.

E. Refrigerator/Freezer REF-07: Medication refrigerator/freezer combo.

1. Product: True Manufacturing Company; T-23DT.

2.4 DISHWASHERS

A. Dishwasher DW-01: Complying with AHAM DW-1.

1. Basis-of-Design Product: Frigidaire; FDB2410HIS.
2. Type: Built-in undercounter
3. Dimensions: 24 inches wide, 23 inches deep, 34-1/2 inches tall.
4. Other Features: Hi-temp wash setting.
5. Appliance Color/Finish: As selected by Architect from Manufacturer's standard range.

2.5 CLOTHES WASHERS AND DRYERS

A. Clothes Washer CLW-01: Complying with AHAM HLW-1.

1. Product: Speed Queen; FTSAOAWN.

B. Clothes Dryer CLD-01: Complying with AHAM HLD-1.

1. Product: Speed Queen; FES17AWF15OO.

C. Stacking Clothes Washer/Dryer CLS-01 : Complying with AHAM HLW-1 and AHAM HLD-1.

1. Product: Speed Queen; LTSA9AWN.

2.6 AUDIOLOGY BOOTH

A. Audiology Booth AB-01: Single-Wall Control Room integrated with a Double-Wall Exam Room.

1. Product: Industrial Acoustics Company; 140 ACT-3.

2.7 CLINICAL EQUIPMENT AND ACCESSORIES

A. Glove Dispenser Box Holder DSG-01: Wall-mounted holder for 3 boxes of gloves.

1. Product: Moore Medical; 73132.
2. Material: Vinyl coated metal.

B. Hand Sanitizer Dispenser DSG-02.

1. Product: Gojo Purell; ADX-7.

C. Exam Table EC-01.

1. Product: Midmark; Ritter 622.
2. Features: Built-in receptacle.
3. Color/finish: As selected by Architect from manufacturer's standard range.

D. Exam Table EC-02.

1. Product: Midmark; Ritter 602.
2. Features: Built-in receptacle.
3. Color/finish: As selected by Architect from manufacturer's standard range.

E. Exam Instrument Panel EIP-01.

1. Product: Welch Allyn Green Series; 77791-MX.
2. Blocking: Provide blocking as recommended by manufacturer.

F. Exam Instrument Panel EIP-02.

1. Product: Welch Allyn Green Series; 77794-MSPOT.
2. Blocking: Provide blocking as recommended by manufacturer.

G. Exam Light EXL-01: Ceiling-mounted exam light.

1. Product: Phillips Burton; OP216SC.
2. Blocking: Provide blocking and required steel support as recommended by manufacturer.

H. Nurse Pull Cord NC-01: Bathroom/Urgent Call Station.

1. Product: Cornell; E-704.

I. Nurse Duty Station NC-02: Duty Station with Tone on/off switch.

1. Product: Cornell; D-111.

J. Sharps Disposal Container SDC-01.

1. Product: Becton Dickinson; 305443.

K. Specimen Pass-Thru Cabinet SPT-01.

1. Product: Bradley Corporation; 9813.

L. Refrigerator Temperature Monitor TMP-01.

1. Product: Sensaphone; Web-600.

2.8 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Examine walls, ceilings, and roofs for suitable conditions where will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Built-In Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Utilities: Comply with plumbing and electrical requirements

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain appliances and equipment.

END OF SECTION 11 31 00

SECTION 11 40 00

FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Furnish all labor, materials, services, equipment and appliances required to provide and deliver all foodservice equipment hereinafter specified into the building, uncrate, assemble, hang, set-in-place, level, and completely install, exclusive of final utility connections.

B. Related Work Specified Elsewhere:

1. All plumbing, electrical and ventilating work required in conjunction with commercial foodservice equipment including rough-in to points indicated on mechanical drawings, and final connections from rough-in points, electrical service to points of connection and final connections shall be by Divisions 22, 23 and 26.
2. Refrigeration work will be done by the Kitchen Equipment Contractor except for electrical and plumbing connections to and between compressors, blower coils, controls, etc. These final connections shall be by Divisions 22 and 26.
3. All traps, steam traps, grease traps, line strainers, tail pieces, valves, stops, shut-offs, and fittings necessary for equipment specified will be furnished and installed under mechanical contract by Division 22 unless specifically called for otherwise under each item.
4. All line and disconnect switches, safety cut-offs and fittings, convenience boxes or other electrical controls, fittings and connections will be furnished and installed under electrical contract by Division 26, unless specifically indicated otherwise in the item specifications. Starting switches for certain specified pieces of foodservice equipment are to be provided by Kitchen Equipment Contractor. Those starting switches, if furnished loose as standard by Foodservice Manufacturers (other than fabricated items), shall be mounted and wired complete under Division 26.
5. Any sleeves or conduit required for refrigeration, syrup tubing, or carbonation tubing will be furnished and installed under Division 22.
6. Unless specifically called for in the Item Specifications, ventilating fans and all duct work between same and ceiling rough-in openings, and from same to discharge opening in building will be furnished and installed by Division 22.

1.2 DEFINITIONS

A. All references to the terms "Contractor", "Kitchen Equipment Contractor", or "K.E.C." in the specifications and/or on the drawings shall be defined to mean the Kitchen Equipment Contractor.

B. All references to the term "Owner" in the specifications and/or on the drawings shall be defined to mean the Owner or Owner's designated representative and the Foodservice Equipment Consultant.

C. All references to the term "Consultant" or "Foodservice Equipment Consultant" in the specifications and/or on the drawings shall be defined to mean **NYIKOS ASSOCIATES, INC.** its employees, and authorized representatives and is referred to throughout the contract documents as if singular in number and masculine in gender.

D. The phrase "The K.E.C. shall" or "by the K.E.C.", as applicable, is understood to be included as a part of each sentence, paragraph or article of these specifications unless otherwise indicated or specified.

1.3 QUALITY ASSURANCE

A. Qualification of Suppliers:

1. Commercial foodservice equipment suppliers shall submit satisfactory evidence of compliance with the following qualifications and conditions to be approved.

a. Successful completion of jobs of comparable scope.
b. Have manufacturer's authorization to distribute and install specified factory items of equipment.
c. Maintain a permanent staff experienced in the installation of foodservice equipment and preparation of professional style rough-in drawings and brochures.
d. Maintain or have access to fabrication shop meeting N.S.F. requirements. If other than foodservice equipment suppliers own fabrication shop, obtain Consultant approval of fabrication shop desired to be used.
e. Maintain or have access to a readily available stock of repair and replacement parts, together with authorized service personnel.

B. Qualification of Fabricators:

1. Fabricators shall be an N.S.F. approved organization with trained personnel and facilities to properly design, detail and fabricate equipment in accordance with the specifications and standard details contained herein.

2. Custom fabricated equipment shall bear the National Sanitation Foundation seal of approval and listed as such under N.S.F. Standards No. 2 and No. 33.

3. Only one (1) fabricator shall be used for this project, and all equipment will be fabricated at the same shop. Where units cannot be fully shop-fabricated, complete fabrication at project site.

4. Acceptable fabricators are:

a. Pro Stainless, Inc., Keyser, WV
b. Commercial Stainless, Inc., Bloomsburg, PA
c. Keystone Custom Fabricators, Inc.; Elizabeth, PA.
d. Southern Equipment Fabricators, Inc.; Columbia, SC
e. Stainless Unlimited Inc., Waldorf, MD
f. Other fabricators, as approved by Consultant.

C. Qualification of Manufacturers:

1. Manufacturers shall be regularly engaged in the production of items furnished and shall have demonstrated the capability to furnish similar equipment that performs the functions specified or indicated herein.

D. Standard Products:

1. Materials, products, and equipment furnished under this contract shall be the standard items of manufacturers regularly engaged in the production of such materials, products,

and equipment and shall be of the manufacturer's latest design that complies with the specifications which have been produced and used successfully on other projects and in similar applications.

2. Discrepancies within contract documents should immediately be brought to the attention of the Consultant in writing for clarification prior to fabrication or ordering of standard items.

1.4 PLANS & SPECIFICATIONS

A. Specifications and drawings have been prepared to form the basis for procurement, erection, start-up and adjustment of all equipment in this contract. Plans and specifications shall be considered as mutually explanatory and work required by one, but not the other, shall be performed as though required by both. Items required by one, but not by the other shall be provided as though required by both. Work shall be accomplished as called for in specifications and shown on drawings, so that all items of equipment shall be completely functional for purpose for which they were designed. When there is any discrepancy between drawings and specifications, drawings shall govern. Bidders should seek clarification of any discrepancies from the Consultant prior to bidding.

1.5 SUBMITTALS

A. General Requirements:

1. Within six (6) weeks or earlier, as required, assemble and submit all shop drawings, rough-in drawings, brochures, color samples, etc. as a complete package. There will be no review of partial submittals.
2. Any and all costs, to all trades and parties involved, arising from delay of project due to non-submittal of the complete package by the K.E.C. within a reasonable time period shall be borne solely by the K.E.C.
3. Identify each submittal by project name, date, contractor, submittal name, and any other necessary information to distinguish it from other submittals.

B. Shop Drawings:

1. Submit electronic copy of drawings equal in size to Contract Documents of equipment specified for custom fabrication including all accessories attached to each item.
2. Drawings shall be detailed and fully dimensioned to a minimum scale of 3/4"=1'-0" for plan and elevation views, and 1-1/2"=1'-0" for sections, based on the floor plan(s) and following item specifications. Drawings will be checked for thoroughness, accuracy, completeness, neatness, and returned for corrections, if necessary.

C. Rough-in Drawings:

1. Submit electronic copy of drawings equal in size to Contract Documents of detailed arrangement plans professionally prepared from architects dimensioned plans (not traced from Contract Documents) at a minimum scale of 1/4"=1'-0".
2. Equipment Layout Plan showing arrangement of all items specified and identified on schedule of equipment listing item number, description, quantity, manufacturer, model number, and remarks.
3. Ventilation Plan showing dimensioned locations of all duct openings for ventilators and dishmachines identifying size, c.f.m. required (exhaust and supply), static pressures, and connection heights.

4. Plumbing/Electrical Plans showing dimensioned locations, sizes, elevations and capacities of all utility services required for each item of equipment in relation to finished walls, columns, and heights above finished floor.
5. Special Conditions Plan showing exact dimensions and details of all masonry bases, floor depressions, critical partition locations/heights, wall openings, reinforcing for wall and/or ceiling mounted equipment, and conduit locations for soda and compressed gas lines.

D. Equipment Brochures:

1. Submit electronic copy of manufacturer's illustrations and technical data for approval prior to procurement. All items of Standard Manufacture shall be submitted, including items purchased to be built into fabricated equipment. Each illustration shall be marked to accurately describe the item to be furnished as specified. Include all deviations from standard information (i.e., voltage, phase, load, etc.).
2. Include a separate information sheet ahead of each illustration sheet showing all service connection sizes, electrical requirements, loads, consumptions, and all accessories specified.
3. Manufacturer's suggested schematic drawings for connection of mechanical and electrical services for such items as booster heaters, disposers, or any other item of equipment that may require the same.

E. Miscellaneous Shop Drawings:

1. Submit electronic copy of drawings of manufactured equipment specified requiring clarification and approval such as, walk-in cooler/freezer drawings, ventilator drawings, utility raceway drawings, and refrigeration system drawings.

F. Operation and Maintenance Manuals:

1. Submit electronic copy for all mechanically operated equipment of standard manufacture. Include operating and cleaning/maintenance instructions, parts listing, recommended parts inventory listing and purchase source, copy of warranties, and similar applicable information.
2. Brochure covers shall bear the job name, date, and name of contractor.

G. Manufacturer's List:

1. The K.E.C. shall submit in writing a list of all manufacturer's representatives of the food service equipment such as convection ovens, ranges, etc., and their authorized service agencies' addresses and telephone numbers; to be presented after submission of manufacture data.

H. Samples:

1. Samples of materials, products, and fabrication methods, shall be submitted for approval upon request at no additional cost, before proceeding with work.

I. Re-submission Requirements:

1. Shop Drawings:
   a. Revise initial drawings as required and resubmit in accordance with submittal procedures.
   b. Indicate on drawings all changes which have been made in addition to those requested by Consultant.

2. Product Data and Samples:

   a. Submit new data and samples as required for initial submittal.
   b. Make all re-submittals within fourteen (14) working days from date of Consultants previous action.

J. Approvals:

1. After approval of the submittals listed above, furnish as many prints and copies as are required for the various trades, the Owner, the Architect, and the Consultant.
2. The approval of the shop drawings will be general and shall not relieve the K.E.C. of responsibility for proper fitting, finishing, quantities, and erection of work in strict accordance with the contract requirements, nor does it relieve him of the responsibility of furnishing material and workmanship not indicated on approved shop drawings but required for the completion of his work.
3. Approval by the Consultant and/or Owner of the manufacturer's data submitted by the K.E.C. does not waive the responsibility of K.E.C. to furnish each item of equipment in complete compliance with the specifications and drawings. Discrepancies between Contract Documents and furnished equipment shall be corrected even after approval and installation of this equipment at no additional cost to the Owner.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Equipment shall be delivered to the job site only after the building is weather-safe and vandal-safe.

B. Storage:

1. Store equipment in an area convenient to the point of installation in such a way that it is protected from the weather and job hazards.

C. Protection:

1. Wrapping and protective coatings shall remain on all items until ready for use and in the case of stainless steel items, until installation is complete and the job is ready for cleaning.

D. Damage:

1. All responsibility shall rest with the K.E.C. for any damage or loss incurred prior to final acceptance. Such items as may be lost or damaged shall immediately be replaced or repaired to a new condition to the complete satisfaction of and at no additional cost to the Owner.

1.7 JURISDICTION TRADE AGREEMENTS AND RESTRICTIONS

A. Include the work specified, shown or reasonably infer able as part of foodservice equipment. Portions of this work may be subcontracted to those qualified to do such work, as may be necessary because of jurisdictional trade agreements and restrictions.

1.8 REGULATIONS AND CODES

A. Except as otherwise indicated, each item of equipment shall comply with the latest current edition of the following standards as applicable to the manufacture, fabrication, and installation of the work in this section.

1. N.S.F. Standards: Comply with National Sanitation Foundation Standards and criteria, and provide N.S.F. "Seal of Approval" on each manufactured item and major items of custom-fabricated work.
2. U.L. Standards: For electrical components and assemblies, provide either U.L. labeled products or, where no labeling service is available, provide a complete index of the components used as selected from the U.L. "Recognized Component Index".
3. A.N.S.I. Standards: For gas-burning equipment, comply with A.N.S.I. Z21-Series standards. Comply with A.N.S.I. B57.1 for compressed gas cylinder connections and with applicable standards of the Compressed Gas Association for water connection air gaps and vacuum breakers.
4. A.G.A.: All gas-fired equipment shall be A.G.A. Approved, equipped to operate on the type gas available at the job site and shall contain 100% automatic safety shut-off devices.
5. N.F.P.A. Standards: Comply with N.F.P.A. Bulletin 96 for exhaust systems and with N.F.P.A. Bulletins 17 & 96, and U.L. 300 for fire extinguishing systems.
6. A.S.M.E. Code: Comply with A.S.M.E. boiler code requirements for steam generating and steam heated equipment. Provide A.S.M.E. inspection, stamps, and certification of registration with National Board.
7. National Electric Code: Comply with N.E.C. Volume 5 for electrical wiring and devices included with foodservice equipment.
8. All authorities having jurisdiction over this type of equipment and/or installation.
9. Where specifications and/or drawings require mechanical, electrical or refrigeration work to be performed, such work shall be done in strict conformance to other portions of the Base Building Specification which sets forth standards for this type of work.
10. Where there exists two standards or codes for one type of work, the stricter method shall govern.

1.9 WARRANTIES

A. Warrantee in writing all equipment and fabrication against defects and workmanship for a period of two (2) years from date of acceptance.

1. Each piece of mechanical equipment shall be listed, together with the authorized service and repair agency whom the Owner will call should malfunctions occur within the two-year (2) guarantee period.

B. Refrigeration system compressors shall be warranted for five (5) years by the manufacturer. Free refrigeration service, including parts and labor, shall be furnished for two (2) years from date of acceptance, unless otherwise specified.

1.10 JOB CONDITIONS

A. Visit the job site to field check actual wall dimensions and roughing-in and shall be responsible for fabricating and installing the equipment in accordance with the available space and utility services as they exist on the job site.

B. Check all door openings, passageways, elevators, etc., to be sure that the equipment can be conveyed to its proper location within the building and if necessary, check the possibility of holding wall erection, placement of doorjambs, windows, etc. for the purpose of moving the equipment to its proper location with the General Contractor. Any removal and rebuilding of walls, partitions, doorjambs, etc. necessary to place the equipment, or if caused by incorrect information on the Contractor's drawings, shall be done at the expense of the K.E.C., at no additional cost to the Owner.

C. Notify the Consultant and Owner before fabrication of equipment of any discrepancies between plans and specifications and actual conditions on the job.

D. Before finished floors, walls, and/or ceilings are in place, physically check the location of all "rough-ins" at the job site. Report discrepancies in writing.

E. Any changes required after fabrication has been started to ensure equipment accurately fitting the space as it exists and conforming to actual field dimensions on the job shall be made at no additional cost to the Owner.

F. If special hoisting equipment and operators are required, include such cost as part of the bid for this work.

1.11 CHANGES IN THE WORK

A. The Owner reserves the right to require reasonable modification to be made in the routing of work and relocation of equipment. This specifically refers to conditions where interference occurs or where more desirable accessibility can be obtained or whose materials cannot be installed because of structural or mechanical conditions encountered. Such changes shall be made at no additional cost to the Owner.

1.12 PATENTS

A. Hold harmless and save the Owner and its officers, consultants, servants and employees from liability of any nature or kind, including costs and expenses for or on account of any copyrighted, patented, or un-patented invention, process, trademark, design, device, material, article, or appliance manufactured or used in the performance of the contract, including its use by the Owner, unless otherwise specifically stipulated in the Contract Documents.

B. If the Contractor has information that the process or article specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the Owner in writing. The contract price shall include all royalties or costs arising from the use of any or all of the above which are, in any way, involved in the contract.

1.13 CONTRACTOR'S WARRANTY

A. The Contractor represents and warrants:

1. That he is financially solvent and that he is experienced in and competent to perform the types of work or to furnish the plans, materials, supplies or equipment, to be so performed or furnished by him.
2. That he is familiar with all Federal, State, municipal, and department laws, ordinances, orders, and regulations, which may, in any way, affect the work of those employed

therein, including, but not limited to, any special acts relating to the work or to the project of which it is a part.

3. That such temporary and permanent work required by the contract as is to be done by him can be satisfactorily constructed and used for the purpose for which it is intended and that such construction will not injure any person or damage any property.
4. That he has carefully examined the plans, specifications, addenda, if any, and the site of the work and that, from his own investigations, he has satisfied himself as to the nature and location of the work, the character, quality, and quantity of materials likely to be encountered, the character of equipment and other facilities needed for the performance of the work, the general and local conditions, and all other materials which may, in any way, affect the work or its performance.
5. That he has satisfied himself as to the existing openings and accesses to the foodservice area through which his equipment shall be required to pass and that he is responsible for his equipment being delivered in as many sections as necessary to conform to the available space dictated by these existing limitations.

1.14 SUBSTITUTIONS

A. Bids submitted shall be for the specific manufacturer and model, size, capacity, and accessories, as specified or shown on the drawings.

B. The K.E.C. may quote upon brands and models of equipment other than those specified as a substitute, but he must also bid the primary item. In the event that it is desired to request approval of substitute material, product, article, process, or item of equipment in lieu of that which is specified, submit a written request at the time of submitting bid on a separate sheet attached to, but not part of, the base bid, setting forth the proposed substitution in detail, including an itemized analysis of the addition or deduction in the amount of the contract, if any, which will result if the substitution is approved. Each such request shall include a complete description of the proposed substitute, the name of the material or equipment for which it is to be substituted, drawings, cuts, performance and test data and any other data or information necessary for a complete evaluation.

C. The Contractor shall be held responsible for additional costs to himself or any other prime contractor for changes required to install materials, devices, equipment, etc., which the Contractor has substituted for that specified.

D. The Owner reserves the right to award a contract or contracts based upon the inclusion or exclusion of one or more of the alternate estimates. The description of all workmanship and materials under the various headings of the specifications shall have the same meaning and force when applied to similar workmanship and materials in the alternate. If the descriptions are not specific, the workmanship shall be the best quality and the materials the best commercial grade.

E. Whenever any product is specified in the Contract Documents by reference to the name, trade name, make, or catalog number of any manufacturer or supplier, the intent is not to limit competition but to establish a standard of quality which is necessary for the project. Products of other manufacturers meeting the established criteria will be considered. However, please take note that the plumbing, electrical, steam, heating, ventilating, and air-conditioning drawings prepared by the consulting engineers, have been engineered based on the first product named under each item number designation. Therefore, any other product which is submitted for approval in lieu of the primary item specified, shall conform to the rough-in requirements established for the first product named, as well as physical size and building construction requirements.

F. Any equipment listed, which is not in accordance with the provisions of these specifications, will be rejected. If the Contractor fails to submit for approval within the specified time the list of equipment as required herein, the Consultant shall then have the right to make the final equipment selection. The selection made by the Consultant shall strictly conform to these specifications and will be final and binding, and the items shall be furnished and installed by the Contractor without change in the contract price at the time of completion.

G. It shall be the responsibility of the K.E.C. to prove that substitutions are equal to specified items. **NYIKOS ASSOCIATES, INC.** as the Owner's representative, shall be the determining authority as to the acceptability or equality of the substitutions. No substitutions shall be approved after bids are received.

1.15 DESIGN/MODEL CHANGE, DISCONTINUED ITEMS

A. All equipment specified shall be of latest design. Any improvements made in design and construction of prefabricated items before equipment is actually delivered to the project site, shall be incorporated in equipment, at no additional cost, provided such incorporation does not delay delivery date of equipment.

B. In the event of an item being discontinued after specified and prior to delivery to project site, the K.E.C. shall be responsible for notifying the Consultant in writing of the discontinued item and request an alternate of equal performance, including all accessories, at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. The equipment and its component parts shall be new and unused. All items of standard manufactured equipment shall be current models at the time of delivery. All parts subject to wear, breakage, or distortion shall be accessible for adjustment, replacement, and repair.

B. Means shall be provided to ensure adequate lubrication for all moving parts. All oil holes, grease fittings, and filler caps shall be accessible without the use of tools.

C. The design of the equipment shall be such as to provide for safe and convenient operation. Covers or other safety devices shall be provided for all items of equipment presenting safety hazards. Such guards or safety devices shall not present substantial interference to the operation of the equipment. All guards shall provide easy access to the guarded parts.

D. Trim shall not be an acceptable substitute for accuracy and neatness. When trim is required and accepted by the Consultant and the Owner in lieu of rejection of items of equipment, it shall be the K.E.C.'s responsibility to provide same at no additional cost.

E. Unless otherwise specified herein, no material lighter than #20 gauge shall be incorporated into the work. All gauges for sheet iron and sheet steel shall be U.S. Standard Gauges, and finished equipment gauge thickness shall not vary more than 5% plus or minus from the thickness indicated below.

GAUGE	THICKNESS	GAUGE	THICKNESS
#10	0.1406	#16	0.0625
#12	0.1094	#18	0.0500
#14	0.0781	#20	0.0375

F. Materials or work described in words which have a well known and acceptable trade meaning shall be held to refer to such accepted meanings.

2.2 MATERIALS

A. Refrigeration Systems:

1. Self-contained:

a. Whether the units be top-mounted or cabinet-mounted, they shall be started by the K.E.C. and shall be tested for maintenance of temperature.
b. All units shall be furnished with condensate evaporators.

2. Remote: Provide and install complete refrigeration system(s), charged, started, and operating properly, according to the Item Specifications and the following.

a. Single stage compressors with air-cooled condensers operating within the recommended range of suction discharge pressure of economical operation and within the required capacity.
b. All units shall be new and factory assembled, to operate with the refrigerant specified. Refrigerant R-404A shall be used for all medium and low temperature applications. Due to the unsettled nature of refrigerants, no refrigerant shall be used with a phase-out date of less than ten (10) years from the date of installation.
c. Compressors shall be accessible hermetic type, Copeland or approved equal, and shall be equipped with high-low pressure control, liquid line drier, sight glass, suction and discharge vibration eliminator, and head pressure control.
d. The system shall have a factory mounted and pre-wired control panel complete with main fused disconnect, compressor circuit breakers, contactors, and time clocks wired for single point power connection.
e. The supporting frame shall be constructed of structural steel, fully welded, and protected against rust and corrosion with one (1) coat primer, and two (2) coats paint, unless otherwise specified.
f. Systems specified for outdoor installation shall be fully protected in a weather-proofed housing with louvered front panel and hinged top, constructed to resist rust and corrosion, and furnished with low ambient controls. Crankcase heater shall be provided with every compressor.

3. Where specifications call for pre-piped lines (i.e., from a fixture to a valve compartment, etc.), provide such work in strict conformance with other sections of the specifications which set forth standards for this type of work or in conformity with the requirements of the Board of Fire Underwriters or ASHRAE Standards, whichever is greater.
4. Each refrigeration item specification is written to provide minimum specifications and scope of work. All refrigeration equipment shall be designed and installed to maintain the following general temperatures unless otherwise specified.

TYPE	REFRIGERATORS	FREEZERS
a. Walk-In	+35º F./1.7º C.	-10º F./-23.3º C.
b. Reach-In	+35º F./1.7º C.	-10º F./-23.3º C.
c. Undercounter	+35º F./1.7º C.	-10º F./-23.3º C.
d. Fabricated	+35º F./1.7º C.	-10º F./-23.3º C.
e. Cold Pans	+0º F./-17.8º C.	
f. Work Rooms	+50º F./10º C.	

5. Provide (including payment if subcontracted) all electrical and refrigeration components needed by the completed system and complete (or have completed by the respective trades) all connections of and to said components.

6. An evaporator coil defrost system shall be provided and installed by the K.E.C. on all refrigeration systems designed to operate at an evaporator coil temperature of less than +35º F. Evaporator coil units provided without electric defrost feature shall be installed with a solenoid valve in the liquid line, controlled by the time clock so as to shut off the flow of refrigerant and allow the compressor to pump down and shut off by activation of the pressure control switch.
7. Verify the requirements of and provide any or all additional refrigeration specialty(s) or component(s) required or recommended by the manufacturer for proper operation under the specific operating conditions and location of each system specified.
8. Verify and provide manufacturer's certification that the equipment selection hereinafter specified for each refrigeration system is properly sized and shall meet the operating requirements set forth for each system regarding maintaining specified operating temperature, hours of compressor running time, and system pressures and velocities as recommended by the equipment manufacturer(s).
9. All refrigeration systems shall be installed and wired in strict conformance with the manufacturer's instructions and recommendations.

B. Motors and Heating Elements:

1. Motors up to and including 1/2 HP shall be wired for 120 volt, single phase service. Motors larger than 1/2 HP shall be wired for 208 volt, single or three phase service as indicated. Motors shall be of the drip-proof, splash-proof, or totally enclosed type, having a continuous duty cycle and ball bearings, except small timing motors which may have sleeve bearings. All motors shall have windings impregnated to resist moisture. Motors located where subject to deposits of dust, lint, or other similar matter shall be of the totally enclosed type. Motors shall have ample power to operate the machines for which designated under full load operating conditions without exceeding their nameplate ratings. Insulation shall be N.E.M.A. Class B or better.
2. Heating elements having a connected load up to and including 1,000 watts shall be wired for 120 or 208 volt, single phase service, or as indicated on the drawings.

    a. Any heating element larger than 1,000 watts or any combination of elements in one fixture totaling more than 1,000 watts shall be wired for 208 volt single or three phase service, as indicated on the drawings.
    b. Fixtures having multiple heating elements may be wired for three phase service with the load balanced as equally as possible within the fixture.

C. Switches and Controls:

1. Provide recognized commercial grade signals, "on-off" pushbuttons or switches, and other speed and temperature controls as required for operation of each item, complete with pilot lights and permanent graphics, conspicuously labeled, to assist the user of each item.
2. Mount switches and controls directly adjacent the piece of equipment for which it involves, on operator's side of counter body apron, out of view to the public.
3. Provide on or for each motor-driven appliance or electrical heating or control unit, a suitable control switch or starter of the proper type and rating and in accordance with Underwriter's Code wherever such equipment is not built in. All other line switches, safety cut-outs, control panels, fuse boxes, other control fittings and connections, when not an integral part of the unit or furnished loose by the manufacturer will be furnished and installed by the Electrical Contractor, unless otherwise specified. All electrical controls, switches, or devices provided loose for field installation as a part of the item specified shall be installed in the field by the Contractor unless otherwise specified.
4. Appliances shall be furnished complete with motors, driving mechanisms, starters, and controllers, including master switches, timers, cut-outs, reversing mechanisms, and other electrical equipment if and as applicable.

D. Cover Plates:

1. All controls mounted on vertical surfaces of fixtures shall be set into recessed die stamped stainless steel cups, or mounted onto removable cover plates in such a fashion as to not protrude or interfere with the operation of each item.
2. Cover plates shall be furnished and installed for all electrical outlets, receptacles, switches and controls furnished by the K.E.C., and shall match the material and finish of the equipment to which they will be fastened.

E. Wiring and Conduit:

1. Wiring shall be properly protected in N.E.M.A. and U.L. approved metal enclosures. Only rigid steel conduit shall be used, zinc coated where unexposed and chrome plated where exposed. All wiring shall be run concealed wherever possible.
2. All equipment furnished under this contract shall be so wired, wound, or constructed so as to conform with the electrical characteristics at the job site.
3. Wiring and connection diagrams shall be furnished with electrically operated machines and for all electrically wired fabricated equipment.
4. Furnish all foodservice equipment completely wired internally using wire and conduit suitable for a wet location. Where an Electrician's services are required, the work shall be done in the K.E.C.'s factory or at his expense at the job site at no additional cost to the Owner. Provide all electrical outlets and receptacles required to be mounted on or in fabricated equipment and interconnect to a master circuit breaker panel with all wires neatly tagged showing item number, voltage characteristics, and load information. Final connection shall be made by the Electrical Contractor.

F. Cords, Plugs, and Receptacles:

1. The Electrical Contractor shall provide three- or four-wire, grounding-type receptacles for all wall and floor mounted outlets to be used for plug-in equipment with characteristics as noted on the drawings. Provide "Hubbell" three-wire or four-wire grounding-type connectors and neoprene cords installed on each item of plug-in equipment, as indicated on drawings and item specifications.
2. K.E.C. shall coordinate with the Electrical Contractor so that the receptacles provided will match the specific plugs provided as part of the plug-in equipment. Any changes in cords and plugs required in the field due to lack of coordination between the Electrical Contractor and the K.E.C. shall be the latter's responsibility.
3. Reduce the length of all cords furnished with the specified equipment to a suitable or appropriate length so they do not interfere with other equipment or operations.
4. Pedestal receptacles that are part of fabricated equipment exposed to view, shall be similar to T&S Model No. B-1508DD single face, single gang or Model No. B-1528DD single face, double gang.

G. Water Inlets:

1. Water inlets shall be located above the positive water level wherever possible to prevent siphoning of liquids into the water supply system. Wherever conditions shall require a submerged inlet, a suitable type of check valve (except in jurisdictions where check valves are prohibited) and vacuum breaker shall be placed on the fixture to form a part of same to prevent siphoning. Where exposed to view, piping and fittings shall be chrome-plated.

H. Drain Lines:

1. Plumbing Contractor shall provide and install indirect waste lines from equipment which will discharge into floor drains or safe wastes in accordance with Plumbing Rough-In Plans, chrome-plated where exposed. Extend to a point at least 1" (or as required by local codes) above the rim of the floor drain, cut bottom on 45E angle and secure in position.
2. All horizontal piping lines shall be run at the highest possible elevation and not less than 6" above finished floor, through equipment where possible.
3. No exposed piping in or around fixtures or in other conspicuous places shall show tool marks of more than one thread at the fitting.
4. All steam operating valves on or in fabricated and purchased foodservice equipment shall be provided with composition hand wheels, which shall remain reasonably cool in service.
5. Provide suitable pressure regulating valves for all equipment with such components that might reasonably be expected to be affected over a period of time by adverse pressure conditions.

I. Faucets, Valves and Fittings:

1. All sinks shall be fitted with chromium plated, swing spout faucets of same manufacturer throughout as follows, or otherwise specified in Item Specifications.

   a. Prep and Utility Sinks:
      1.) Splash-Mounted:
         a.) T&S Brass and Bronze Works, Inc., Model B-231.
         b.) Fisher Manufacturing Company, Model 3253.
      2.) Deck-Mounted:
         a.) T&S Brass and Bronze Works, Inc., Model B-221.
         b.) Fisher Manufacturing Company, Model 3313.

   b. Pot Sinks:
      1.) Splash-Mounted:
         a.) T&S Brass and Bronze Works, Inc., Model B-290.
         b.) Fisher Manufacturing Company, Model 5214.

2. Pre-Rinse Assemblies:

   a. Splash-Mounted:
      1.) T&S Brass and Bronze Works, Inc., Model B-133 with B-109 wall bracket.
      2.) Fisher Manufacturing Company, Model 2210 with 2902-12 wall bracket.

   b. Deck-Mounted:
      1.) T&S Brass and Bronze Works, Inc., Model B-143 with B-510 mixing valve and B-109 wall bracket.
      2.) Fisher Manufacturing Company, Model 2810 with 2805-CV mixing valve and 2902-12 wall bracket.

3. Vacuum Breakers:

   a. General Use:
      1.) Fisher Manufacturing Company, Model 3990-8000.

   b. Disposers:
      1.) Splash-Mounted:
         a.) T&S Brass and Bronze Works, Inc., Model B-455.
         b.) Fisher Manufacturing Company, Model 3990.

2.) Deck-Mounted:
a.) T&S Brass and Bronze Works, Inc., Model B-456.
b.) Fisher Manufacturing Company, Model 3991.

4. Trough Inlets:

a. Fisher Manufacturing Company, Model No. 2905.

5. Other specialty faucets, pre-rinse assemblies, vacuum breakers, and trough inlets, as specified under Item Specifications.
6. All sink compartments shall be fitted with 2" NPT male, chrome-plated, brass rotary waste valves complete with overflow assemblies and stainless steel strainers.

a. Prep and General Utility Sinks:
1.) Fisher Manufacturing Company, Model No. 6100.

b. Pot Sinks:
1.) Fisher Manufacturing Company, Model No. 6102.

7. Refer to Division 22 for all other fittings.

J. Metals and Alloys:

1. Stainless steel sheets shall conform to ASTM 240, Type 302, Condition A, 18-8, of U.S. Standard Gauges as previously indicated under paragraph 2.1.E.

a. All exposed surfaces shall have a No. 4 finish. A No. 2B finish shall be acceptable on surfaces of equipment not exposed to view.
b. All sheets shall be uniform throughout in color, finish, and appearance.
c. Rolled shapes shall be of cold rolled type conforming to ASTM A36.

2. Stainless steel tubing and pipe shall be Type 304, 18-8, having a No. 4 finish, and shall conform to either ASTM A213 if seamless or ASTM A249 if welded.
3. Where galvanized metal is specified, it shall be copper-bearing galvanized iron, cold-rolled, stretcher leveled, bonderized, re-rolled to insure a smooth surface, and used in the largest possible sizes with as few joints as necessary.
4. Galvanizing shall be applied to rolled shapes in conformance with ASTM A123, and to sheets in conformance with ASTM A526, coating designation G-90.

K. Castings:

1. Castings shall consist of corrosion resisting metal (white metal) containing not less than 30% nickel. All castings shall be rough ground, polished, and buffed to bright lustre and free from pit marks, runs, checks, burrs, and other imperfections. In lieu of corrosion resisting metal castings, die-stamped or cast 18-8 stainless steel will be acceptable.

L. Hardware and Casters:

1. All hardware shall be of heavy-duty type, satin finished chromium plated brass, cast or forged or highlighted stainless steel of uniform design. All hardware shall be a well-known brand, and shall be identified by the manufacturer's name and model number for easy replacement of broken or worn parts.
2. Casters on custom-built equipment shall be heavy-duty type, ball bearing, solid or disc wheel, with grease-proof rubber, neoprene, or polyurethane tire. Wheel shall be 5"

diameter, minimum width of tread 1-3/16", minimum capacity per caster 250 pounds, unless otherwise noted.

a. Solid material wheels are to be provided with stainless steel rotating wheel guard.
b. All casters shall have sealed wheel and swivel bearings, polished plated finish and be N.S.F. approved.
c. All equipment specified with casters shall have a minimum of two (2) with brakes installed on opposite corners, unless otherwise noted.

M. Locks:

1. When specified, doors and drawers of all custom fabricated or manufactured equipment shall be provided with cylinder locks, disc tumbler type with stainless steel faceplate as manufactured by Standard-Keil Mfg. Co., or approved equal.

a. Provide two (2) sets of keys for each lock.
b. All locks shall be keyed alike, except at cashiers stations or unless otherwise specified.

N. Thermometers:

1. All fabricated refrigerated compartments shall be fitted with exterior mounted, adjustable, dial or digital thermometers with flush bezels, and shall be calibrated after installation.

O. Sealants:

1. Sealant, wherever required, shall conform to ASTM C 920; Type S Grade NS, Class 25, Use Nt, with characteristics that when fully cured and washed meets requirements of Food and Drug Administration Regulation 21 CFR 177.2600 and N.S.F. RTV-732 for use in areas where it comes in contact with food.
2. Dow-Corning #780 or General Electric "Silastic", or approved equal, in either clear or approved color to match surrounding surfaces and applied in accordance with sealant manufacturers recommendations for a smooth, sealed finish.

2.3 FABRICATION AND MANUFACTURE

A. Materials and Workmanship:

1. Unless otherwise specified or shown on drawings, all materials shall be new, of best quality, perfect, and without flaws. Material shall be delivered and maintained on the job in an undamaged condition.
2. Fabrication shall be equal to the standards of manufacture used by all first class equipment manufacturers, performed by qualified, efficient, and skilled mechanics of the trades involved.
3. All items of standard equipment shall be the latest model at time of delivery.
4. All fabricated work shall be the product of one manufacturer of uniform design and finish.
5. Each fabricated item of equipment shall include all necessary reinforcing, bracing, and welding with the proper number and spacing of uprights and cross members for strength.
6. Wherever standard sheet sizes will permit, the tops of all tables, shelves, exterior panels of cabinet type fixtures, and all doors and drainboards shall be constructed of a single sheet of metal.
7. Except where required to be removable, all flat surfaces shall be secured to vertical and horizontal bracing members by welding or other approved means to eliminate all buckle, warp, rattle, and wobble. All equipment not braced in a rigid manner and which is subject

to rattle and wobble shall be unacceptable, and the K.E.C. shall add additional bracing in an approved manner to achieve acceptance.

B. Sanitary Construction:

1. All fabricated equipment shall be constructed in strict compliance with the standards of the National Sanitation Foundation as outlined in their Bulletin on Food Service Equipment entitled "Standard No. 2" dated October 1952, and in compliance with the local and State Public Health Regulations in which the installation will occur.
2. All fabricated equipment shall bear the N.S.F. "Seal of Approval".

C. Construction Methods:

1. Welding:

a. All welding shall be the heliarc method with welding rod of the same composition as the sheets or parts welded. Welds shall be complete, strong, and ductile with excess metal ground off and joints finished smooth to match adjoining surfaces; free of mechanical imperfections such as gas holes, pits, cracks, etc., and shall be continuously welded so that the fixtures shall appear as one-piece construction. Butt welds made by spot solder and finished by grinding shall not be acceptable.
b. Spot welds shall have a maximum spacing of 3". Tack welds shall be of at least 1/4" length, and spaced no greater than 4" from center to center. Weld spacing at the ends of the channel battens shall not exceed 2" centers.
c. In no case shall soldering be considered as a replacement for welding, nor shall any soldering operation be done where dependence is placed on stability and strength of the joint.
d. Fixtures shall be shop fabricated of one piece and shipped to the job completely assembled wherever possible. Equipment too large to transport or enter the building in one piece shall be constructed so that the field joints can be welded at the job site.
e. All exposed joints shall be ground flush with adjoining material and finished to harmonize therewith. Whenever material has been sunk or depressed by welding operation, depression shall be suitably hammered and peened flush with the adjoining surface and ground to eliminate low spots. In all cases the grain of rough grinding shall be removed by successive fine polishing operations.
f. All unexposed welded joints on undershelves of tables or counters of stainless steel shall be suitably coated at the factory with an approved metallic-based paint.
g. After galvanized steel members have been welded, all welds and areas where galvanizing has been damaged shall have a zinc dust coating applied in conformance with Military Specification Number MIL-P-26915.

2. Joints:

a. Butt joints and contact joints, wherever they occur, shall be close fitting and shall not require a filler. Wherever break bends occur, they shall be free of undue extrudence and shall not be flaky, scaly, or cracked in appearance; where such breaks do mar the uniform surface appearance of the material, all such marks shall be removed by suitable grinding, polishing, and finishing. Wherever sheared edges occur, they shall be free of burrs, fins, and irregular projections and shall be finished to obviate all danger of laceration when the hand is drawn over them. In no case shall overlapping materials be acceptable where miters or bullnosed edges occur.
b. Field welded joints shall be ground smooth without dips and irregularities and finished to match original finish.

3. Bolt, Screw and Rivet Construction:

   a. All exposed surfaces shall be free from bolt and screw heads. When bolts are required, they shall be of the concealed type and be of similar composition as the metal to which they are applied.
   b. Where bolt or screw threads on the interior of fixtures are visible or may come into contact with hands or wiping cloths, they shall be capped with a stainless steel or chrome acorn nut and stainless steel lock washer.
   c. If rivets are used to fasten rear paneling to the body of the fixture, such rivets shall be stainless steel. In no case shall iron rivets be used.

4. Sound Deadening:

   a. Schnee Butyl-Sealant 1/2" wide rope continuously between all frame members and underside of stainless steel table tops, overshelves and undershelves.
   b. Tighten stud bolts for maximum compression of sealant.

5. Hi-Liting:

   a. All horizontal edges of stainless steel tops, splashes, tops of raised rolled rims, and edges of all exposed doors, handles and shelf edges shall be hi-lited, in uniform design by grinding with abrasive not coarser than #240 grit, then polishing with compound to a uniform mirror finish.

6. Polishing:

   a. The grain of polishing shall run in the same direction on all horizontal and on all vertical surfaces of each item of fabricated equipment except in the case where the finish of the horizontal sections of each shall terminate in a mitered edge.
   b. Where sinks and adjacent drainboards are equipped with backsplash, the grain of the polishing shall be consistent in direction throughout the length of the backsplash and sink compartment

7. Finishes:

   a. Paint and coatings shall be of an N.S.F. approved type suitable for use in conjunction with foodservice equipment. Such paint or coating shall be durable, non-toxic, non-dusting, non-flaking and mildew resistant, shall comply with all governing regulations, and shall be applied in accordance with the manufacturers recommendations.
   b. All exterior, galvanized parts, exposed members of framework, and wrought steel pipe where specified to be painted shall be cleaned, primed with rust inhibiting primer, de-greased, and finished with two (2) coats of glossy enamel grey hammertone paint, unless otherwise noted.
   c. Where baked enamel finishes are specified, they shall be oven baked on the fixtures for a minimum of 1-1/2 hours at a minimum temperature of 300º Fahrenheit.
   d. Fabricated equipment shall be spray coated with plastic suitable for protecting the equipment during transport and installation. The coating shall be easily removable after the equipment installation is complete at the job site, and final clean-up has begun.

D. Construction:

1. Legs:

a. All tubular stands for open base tables, sinks, or dishtables shall have legs constructed of 1-5/8" O.D. stainless steel tubing, with 1-1/4" O.D., #16 gauge stainless steel crossbracing running between legs at a point 10" above finished floor.
b. All joints between legs and crossbracing shall be welded and ground smooth, full 360°F.
c. The top end of legs shall be closely fitted into fully-enclosed stainless steel conical gussets no less than 3" high, similar to Klein #481-58 or #483-58, or approved equal.
d. Gussets shall be fully welded to framing reinforcing members, so that, set screw is not visible from front.
e. Legs without crossrails will not be accepted.
f. Legs shall be spaced at not more than 5'-6" on centers, unless otherwise specified.

2. Feet:

a. All tubular legs will be swedged for appearance and close fit to United Show Case #BF-158, or approved equal, fully enclosed, stainless steel bullet-shaped foot.
   1.) The foot shall be threaded into a collar and completely welded inside the tubular leg to permit a maximum adjustment of 2" without any thread exposure.
   2.) Threads shall be National Course Series Class 2 fit or better, machined to prevent end play when foot is at maximum adjustment.
   3.) The bullet-shaped foot shall have slightly rounded bottom to protect the floor, and a minimum bearing surface of 3/4" diameter of stainless steel-to-floor contact.
   4.) Bottom of tubular leg shall be finished off smoothly to provide a sanitary fitting and prevent the accumulation of grease or other debris.

b. Cabinet type fixtures shall be mounted on 8" high die-stamped, sanitary, two-piece stainless steel legs no less than 2-3/4" in diameter at the top, Component Hardware #A72-0811, or approved equal.
   1.) The bottom fully enclosed, stainless steel, bullet-shaped foot threads up into the inside of the upper member, with a male threaded 5/8" bushing to permit maximum adjustment of 2" without thread exposure.
   2.) The upper section shall be stamped in a neat design with a flared inverted shoulder and fully welded to a base plate designed for anchoring to the channel underbracing.

3. Table Tops:

a. Tables shall be constructed of stainless steel, and of a thickness not less than #14 gauge with 1-3/4" by 120º rolled edges, or as otherwise specified and detailed.
b. All corners shall be bull-nosed and of the same radius as rolled edges.
c. Joints where required shall be butt-welded and ground smooth to present a uniform one-piece appearance.
d. All tops shall be reinforced on the underside with a fully welded framework of 1-1/2"x1-1/2"x1/8" galvanized steel angles with the framing extending around the top perimeter and crossbraced on 24" maximum centers.
e. 1"x4"x1" galvanized or stainless steel, fully welded, cross channel, closed end members placed at each pair of legs with one (1) channel running lengthwise will also be acceptable.
f. All tops shall be reinforced so that there will be no noticeable deflection.
g. Metal tops where adjacent to walls or other items of equipment, shall be constructed with integral, coved, back and/or endsplashes as required and

specified in accordance with the standard details contained herein. Close all ends of splashes.

4. Enclosed Bases:

   a. All enclosed bases or cabinet bodies shall be of seamless #18 gauge stainless steel construction, enclosed on the ends and sides as required and called for under each item.
   b. Ends of body shall terminate at front or operator's side in a 2" wide mullion, vertical, and completely enclosed. All intermediate mullions shall be completely enclosed.
   c. The bases shall be reinforced at the top with a framework of 1-1/2"x1-1/2"x1/8" galvanized angles, with all corners mitered and welded solid.
   d. Underside of top shall be reinforced with channels and gussets where necessary. Additional angles and cross members shall be provided to reinforce shelves and support tops under heavy tabletop equipment.
   e. Where sinks or other drop-in equipment occur, provide additional reinforcing extending crosswise, both sides of opening.
   f. In the case of fixtures fitting against or between walls, the bodies shall be set in 1" or 2" from the wall line, with the tops continuing to the wall line with integral, coved splashes as specified. Extend vertical face of body to the wall line only. This will permit adjustment to wall irregularities. Vertical trim strips will not be accepted.
   g. Bodies shall be fitted with counter style stainless steel legs as hereinbefore specified.

5. Drawers:

   a. Drawers, where specified, shall have removable pan inserts of #18 gauge stainless steel, and shall be approximately 20"x20"x5" deep unless otherwise specified.
      1.) Perimeter top edge shall be flanged out 1/2".
      2.) All interior horizontal corners shall be rounded on a 1" radius, and all interior vertical corners shall be rounded on a 2" radius.

   b. Fronts shall be double pan #16 gauge stainless steel construction, 1" thick, insulated with a semi-rigid, fiberglass board, unfaced, having a three-pound density.
      1.) The top of the drawer face shall be formed as an integral pull by breaking the front pan back on a 45º angle 1", then straight up 1", back to front 1", and then down at the front 3/4".
      2.) Drawer front shall have all edges and corners ground smooth with a radius edge pull.
      3.) Provide hard rubber button bumpers attached to rear of drawer face at each corner.

   c. The drawer shall have an all welded frame of 1"x1", #16 gauge stainless steel angles sized to fit the removable pan insert.
   d. Drawers shall operate on #14 gauge full-extension slides with stainless steel roller bearings with hardened and ground raceways, Component Hardware, S52 Series, or approved equal. Slides shall be pitched approximately 3/8" per foot to permit self closing action.
   e. Drawers shall be adequately and neatly fitted to the guides to permit easy operation without rattle or binding.
   f. Slides and frame shall be reinforced to support a dead weight of 150 pounds when drawer is fully extended.
   g. Adjustable stops shall be provided for each drawer at the fully-opened position, and be readily liftable by hand for easy removal of drawer.

h. All drawers not mounted inside a cabinet body shall be completely enclosed in an #18 gauge stainless steel box-type enclosure and suspended from angle framing under the fixture top. The housing bottom shall be flanged and welded to an #18 gauge stainless steel reinforcing channel extending across the open end.

6. Sliding Doors:

a. Sliding doors shall be of the double pan type, with the exterior pan constructed of #18 gauge stainless steel with all four sides channeled and corners welded. The interior pan shall be similarly constructed of #20 gauge stainless steel, set into the exterior pan, and welded in place.
b. All doors shall be insulated with semi-rigid fiberglass board, un-faced, having a three-pound density. Styrofoam shall not be acceptable.
c. Doors 18" wide or greater, shall have internally welded 4" wide reinforcing channels to prevent warpage.
d. Each door shall be fitted with a positive flush-type stainless steel pull, Standard-Kiel #1262-1014-1283 recessed handle, or approved equal.
e. In the back of each door install a 1"x1", #16 gauge stainless steel angle stop welded in a suitable location to prevent the doors from overpassing the flush pulls.
f. Doors in the closed position shall overlap each other by no more than 2".
g. Each door shall be fitted with two (2), 1-3/8" ball bearing sheaves fastened to 1"x1/8" stainless steel bar stock welded to the top corners of each door for suspending on an overhead #16 gauge stainless steel channel track. The hangers shall be tapped for 1/4"-20 thumb screw vertical locks which prevent the doors from jumping the track in operation while permitting easy removal for cleaning without tools.
h. Insure that the bottom of the doors are positively and continuously guided to assure proper alignment and passing regardless of the position of each door.
i. Provide hard rubber bumpers for doors to close against to insure quiet operation.

7. Hinged Doors:

a. Hinged doors shall be of the same materials and construction as sliding doors previously specified.
b. Hinges shall be heavy duty, stainless steel, removable type, and fastened by tapping into 1/4"x3/4" stainless steel bar stock inside the door pan and behind the door jamb.
c. The door face shall be flush with the cabinet body when fully closed.
d. Size widths of doors equally when installed in pairs, or in series with other pairs, with no door being greater than 36" in width.
e. Doors shall be held closed by permanent magnetic closure devices of an approved type and of sufficient strength to hold the doors shut. Install two (2) per door (minimum), mounted to the door jamb, top and bottom, with opposing chrome-plated steel plates securely fastened to the inner panel of the doors.

8. Undershelves:

a. All open base tables shall be provided with full-length undershelves of #16 gauge stainless steel fully welded to legs with all joints ground smooth and polished.
b. Front edge shall turn down 1-1/2" and under 1/2".
c. Turn up rear and ends 2", with integral coved radius, when specified.
d. If required by width, provide 1-1/2"x1-1/2"x1/8" galvanized angle bracing mounted to underside, full length.

9. Interior Shelves:

a. All interior shelves within cabinet bodies, enclosed bases and overhead cabinets, shall be of #16 gauge stainless steel.
b. Removable shelves shall be constructed in equal sections, and rest in 1-1/2"x1-1/2"x1/8" stainless steel angle frame. Cove all horizontal corners in accordance with N.S.F. requirements.
c. Stationary shelves shall have 2" turn-up on back and ends, and continuously welded to cabinet body, polished and ground smooth to form a one-piece interior free of any crevices.
d. Front edge shall turn down 1-1/2" and under 1/2", and finished with "z" bar forming completely enclosed edge for maximum strength and sanitation.
e. Provide 1-1/2"x1-1/2"x1/8" angle bracing mounted to underside, full length.

10. Elevated Shelves:

a. Shelves over equipment not adjacent to a wall shall be mounted on 1" diameter #16 gauge stainless steel tubular standards neatly fitted with stainless steel base flanges, unless otherwise specified.
b. The top of the tubular standards shall be completely welded to #14 gauge stainless steel support channels, full width of overshelf.
c. Inside the tubular standard, and welded to same, provide 1/2" diameter steel tension rod extended through countertop and securely anchored to lower framework reinforcing with nuts and lock washers in such a manner as to assure a stable, sway-free structure.
d. If required by width, provide 1-1/2"x1-1/2"x1/8" stainless steel angle bracing mounted to underside, full length.
e. Cantilevered shelves, when called for, shall be #16 gauge stainless steel supported on #14 gauge stainless steel brackets welded to 1-5/8" O.D. stainless steel tubular standards extending through the backsplash, and fully welded to the table framework. Provide Klein #481-SH welded sleeves where standards penetrate backsplash.

11. Wall Shelves:

a. Open wall shelves shall be constructed of #16 gauge stainless steel with back and ends turned up 2", positioned 2" out from face of wall, with all corners welded, and supported on #14 gauge stainless steel brackets.
b. Brackets shall be flanged inward beneath the shelf and at the wall 1-1/2" with intersecting flanges completely welded, and attached to shelf with studs welded to the underside and bolted with stainless steel lock washers and chrome-plated cap nuts.
c. Each bracket shall be fastened to the wall with a minimum of two (2) 1/4"-20 stainless steel bolts anchored securely by means of toggles or expansion shields.

12. Sinks:

a. All sinks shall be the size and shape as shown on drawings, and constructed of #14 gauge stainless steel with backs, bottoms and fronts formed of one continuous sheet and the ends welded in place.

b. Sinks shall have all corners, both vertical and horizontal, coved on a 3/4" radius electrically welded, ground smooth and polished. Solder in filleted corners will not be acceptable.
c. Multiple compartment sinks shall be divided with double wall, #14 gauge stainless steel partitions with a 1/2" radius on top and all corners rounded as other corners, continuously welded, ground smooth and polished.

d. The bottom of each compartment shall be creased to a die stamped recess, tapered and shaped to receive a lever type waste without the use of solder, rivets, or welding.
e. Provide #14 gauge stainless steel waste lever angle bracket mounted to underside of compartment at front.
f. The front and exposed ends of sinks shall be fabricated with a 1-1/2", 180 degree rolled edge. The back and ends adjacent to walls or other fixtures shall be turned up with integral coved edge 12" high and returned 2-1/2" at the top on a 45º angle. Cap ends of all exposed splashes.
g. Unless otherwise specified, two (2) faucet holes on 8" centers shall be provided, located over the centerline of partitions between compartments, 2-1/2" down from splash break.
h. Gussets for legs shall be fully welded all around to #12 gauge stainless steel triangular plates fully welded to underside of sink.
i. Sinks fabricated into working surfaces shall be constructed of the same material and in like manner to sinks specified above, except rolled edge and backsplash shall be omitted and the bowl shall be completely welded integral and flush with the working surface. Where basket type wastes are called for, they shall be fitted with removable seats.
j. Where sink bowls are exposed, the exterior shall also be polished to a #4 finish.

13. Sink Drainboards:

a. Drainboards shall be constructed of the same material as the sinks and shall be welded integral to same.
b. The front portion of drainboards shall continue the 1-1/2", 180º rolled edge of sink bowls on a continuous and level horizontal plane.
c. The surface of the drainboard shall pitch from 2-1/2" at the end furthest from the sink, to 3" at the bowl; or 1/8" per foot. In addition, the bottom surface shall be dished toward the center for complete drainage.
d. The backsplash of the drainboard shall match the rear of the sink contour and shall be welded integral thereto, running parallel to the floor.
e. Drainboards shall be reinforced on the underside with a framework of 1"x4"x1" stainless steel channel underbracing placed at each pair of legs, with exposed ends capped, and one (1) channel running lengthwise.
f. Where disposer cones are fabricated into drainboards, additional 1"x4"x1" stainless steel channels shall be welded into the top framing, spanning the drainboard from front-to-back on both sides of the cone and located not more than 3" to either side.
g. Disposer control panels or switches shall be supported beneath drainboards, when specified, by means of a #12 gauge stainless steel mounting bracket.

14. Dishtable Tops:

a. Dishtables shall be constructed of #14 gauge stainless steel with all corners, both vertical and horizontal, coved on a 3/4" radius electrically welded, ground smooth and polished. Solder in filleted corners will not be acceptable.
b. Fronts and exposed ends shall be fabricated with a 3" high, 1-1/2", 180° rolled edge with rounded corners. The back and ends adjacent to walls or other fixtures shall be turned up with integral coved edge 12" high and returned 2-1/2" at the top on a 45º angle. Cap ends of all exposed splashes.
c. All tops shall slope 1/8" per foot (minimum).
d. Dishtables shall be reinforced on the underside with a framework of 1"x4"x1" stainless steel channel underbracing placed at each pair of legs, with exposed ends capped, and one (1) channel running lengthwise fully welded between front-to-back channels.

e. Where tops fit into dishmachines, they shall turn down and into, forming a sealed watertight fit, and attached according to dishmachine manufacturers instructions.
f. On each side of dishmachine, tables shall be provided with integral splash shields as part of the backsplash.
g. Silicon filling of gaps caused by poor fit will not be acceptable.
h. On corner-type door machines, provide #14 gauge stainless steel wall-mounted, splash panel to protect adjacent wall, full width of door opening.

15. Cafeteria Style Counters:

a. All counters shall be constructed as previously specified under Enclosed Bases.
b. Provide top and bottom framing for each counter food pan, cold pan, coffee urn, ice cream unit, ice bin, dish dispenser, etc., whether a drop-in unit or a cutout for a portable unit.
c. Where plate shelves occur, frame horizontally 8-1/2" back from counter edge or as design dictates, and at bottom of shelf at counteredge.
d. The countertop shall be constructed of #14 gauge stainless steel, as previously specified, with all joints welded, ground and polished.
e. Fronts and exposed ends shall be stainless steel, plastic laminate or other material as noted in the Item Specifications.
f. All display glass shelving shall be 1/4" polished plate glass and fully trimmed with #18 gauge stainless steel formed channels. Top shelves shall be the same width as the shelf below. Shelves shall be supported on 5/8" square, #16 gauge stainless steel perimeter tubing fully welded to 1-1/4" square, #16 gauge stainless steel tubing uprights.
g. Provide appropriate adjustable glass sneeze or breath guards trimmed in stainless steel along front, entire length, mounted in Klein 4465-A brackets.
h. Protector shelf over hot food wells shall be #16 gauge stainless steel supported on 1-1/4" square, #16 gauge stainless steel tubing uprights, with 1/4" polished plate glass front and end panels trimmed in #18 gauge stainless steel channels. When specified for self-service, mount bottom edge of front panel 8" above countertop.
i. All display and protector shelves shall be furnished with full-length fluorescent lights wired to on/off switch in counter apron, with lamps and protective shields. Conceal all wiring in tubular uprights.
j. Refer to Item Specification for changes, as required.
k. Counter shall be internally wired complete by the K.E.C., and in such a way as to meet the requirements of the Electrical Code of the job location.

2.4 EQUIPMENT

A. All items listed on the Contract Documents under the heading "Equipment Schedule" shall be furnished in strict accordance with the foregoing specifications and with the following detailed Itemized Specifications.

B. Manufacturer's names and model numbers are shown establishing quality, size, and finish required, representing the Owner's and Consultant's requirements and basis for bid. Equipment is listed hereinafter with same item numbers as shown on Contract Documents.

PART 3 - EXECUTION

3.1 INSPECTION

A. Before beginning the installation of foodservice equipment, the spaces and existing conditions shall be examined by the K.E.C. and any deficiencies, discrepancies, or unsatisfactory conditions for proper installation of foodservice equipment shall be reported to the Architect in writing.

1. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner satisfactory to the installer.
2. Beginning installation shall constitute acceptance of the area.

3.2 PREPARATION

A. Foodservice equipment drawings are diagrammatic and intended to show layout, arrangement, mechanical and electrical requirements.

B. Field verify all measurements at the building prior to fabrication of custom equipment. Coordinate measurements and dimensions with rough-in and space requirements.

3.3 INSTALLATION

A. The K.E.C. shall coordinate his delivery schedule with the General Contractor to ensure adequate openings in the building to receive the equipment.

B. Equipment shall be un-crated, fully assembled and set level in position for final connections. Parts shipped loose but required for connection shall be properly tagged and shall be accompanied by the necessary installation instructions.

C. Provide a competent, experienced foreman to supervise installation and final connections with other trades.

D. Remote Refrigeration Systems:

1. All refrigeration work where applicable to this contract shall be accomplished in an approved manner, using finest quality fittings, controls, valves, etc.
2. Refrigeration items shall be started up, tested, adjusted, and turned over to the Owner in first class condition and left running in accordance with the manufacturer's instructions.
3. Refrigeration lines and hook-ups shall be completed by the K.E.C. with the exception of electric, water, and drain line final connections unless otherwise specified.
4. All copper tubing shall be refrigerant grade A.C.R. or type "L".
5. Silver solder and/or Sil-Fos shall be used for all refrigerant piping. Soft solder is not acceptable.
6. All refrigerant lines in pipe sleeves or conduit shall be effectively caulked at ends to prevent entrance of water or vermin and at penetrations through walls or floors.
7. All tubing shall be securely anchored with clamps, and suspended lines shall be supported with adjustable hangers at 6'-0" o.c. maximum.
8. Wrap drain line in freezer compartment(s) with approved heat-tape for final connection by Electrical Contractor.

E. Sealing and Caulking:

1. Prior to the application of sealant, all surfaces shall be thoroughly cleaned and de-greased.
2. Apply around each unit of permanent installation at all intersections with walls, floors, curbs or other permanent items of equipment.
3. Joints shall be air-tight, water-tight, vermin-proof, and sanitary for cleaning purposes.

4. In general, joints shall be not less than 1/8" wide, with backer rod to shape sealant bead properly at 1/4" depth. Shape exposed surfaces of sealant slightly concave, with edges flush with faces of materials at joint.
5. At internal corner joints, apply sealant or gaskets to form a sanitary cove, of not less than 3/8" radius.
6. Provide sealant-filled joints up to 3/4" in joint width. Trim strips for wider joints shall be set in a bed of sealant and attached with stainless steel fasteners, 48" o.c., or less, to insure suitable fastening and prevent buckling of the metals fastened.

F. Cutting:

1. All cutting, fitting, or patching required during installation shall be accomplished by the K.E.C., at his own expense, so as to make the work conform to the plans and specifications.
2. The K.E.C. shall not cut or otherwise alter, except with the consent of the Owner, the work of any other Contractor.
3. Provide cut-outs in foodservice equipment where required to run plumbing, electric, or steam lines through equipment items for final connections.

3.4 FIELD QUALITY CONTROL

A. Inspection:

1. Provide access to shop fabrication areas during normal working hours to facilitate inspection of the equipment, during construction, by the Architect or his authorized representative.
2. Errors found during these inspections shall be corrected to the extent required within the scope of the plans, specifications, and approved drawings.

B. Start-Up and Testing:

1. Delay start-up of foodservice equipment until service lines have been tested, balanced, and adjusted for pressure, voltage, and similar considerations; and until water and steam lines have been cleaned and treated for sanitation.
2. Before testing, lubricate each equipment item in accordance with manufacturer's recommendations.
3. Supply a trained person or persons who shall start up all equipment, test and make adjustments as necessary, resulting in each item of equipment, including controls and safety devices, performing in accordance with the manufacturer's specifications.
4. All gas-fired equipment shall be checked by the local gas company as to calibration, air adjustments, etc., and adjustments made as required.
5. Repair or replace any equipment found to be defective in its operation, including items which are below capacity or operating with excessive noise or vibration.

C. Demonstration:

1. Provide an operating demonstration of all equipment at a time of Owner's convenience, to be held in the presence of authorized representatives of the Architect and Owner.
2. Demonstration shall be performed by manufacturer's representative knowledgeable in all aspects of his equipment.
3. During the demonstration, instruct the Owner's operating personnel in the proper operation and maintenance of the equipment.

4. Furnish complete, bound, operation/maintenance manuals and certificates of warranty for all items of equipment provided, in accordance with Article 1.5 Submittals, Paragraph F, at this demonstration time.

3.5 ADJUST AND CLEAN

A. Upon completion of installation and tests, clean and sanitize foodservice equipment, and leave in condition ready for use in food service.

B. Remove all protective coverings, and thoroughly clean equipment both internally and externally with stainless steel cleaner.

C. Make and check final adjustments required for proper operation of the equipment.

D. Restore finishes marred during installation to remove abrasions, dents, and other damages. Polish stainless steel surfaces, and touch-up painted surfaces with original paint.

E. Clean up all refuse, rubbish, scrap materials, and debris caused by the work of this Section, and put the site in a neat, orderly, and broom-clean condition.

3.6 ITEMIZED EQUIPMENT

FIRST FLOOR KITCHEN

ITEM #1: UTILITY CART, MOBILE

QUANTITY:	Two (2)
MANUFACTURER:	Lakeside Manufacturing Company, Inc.
MODEL NO.:	543 (N058)
PERTINENT DATA:	700-Lb. Capacity, 21" x 33" Shelf Size, Two-Tier, NSF Version
UTILITIES REQ'D:	----
ALTERNATE MFRS	None

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. All four (4) casters swivel-type.

ITEM #2: WALK-IN COOLER/FREEZER

QUANTITY:	One (1)
MANUFACTURER:	Bally
MODEL NO.:	Indoor Installation (N058)
PERTINENT DATA:	4" Foamed-In-Place Urethane Panels - Class I, NSF Construction
UTILITIES REQ'D:	1500W, 120V, 1PH; 3/4" IW
ALTERNATE MFRS.:	Master-Bilt; Thermo-Kool; ThermalRite

Furnish and install per Equipment Plan, Sheet K1.1; Building Conditions Plan, Sheet K1.2; Manufacturer's Shop Drawing and the following:

1. Two Section Unit; 31'-8½" L x 9'-8" D x 9'-6" H. Size width of interior compartments equally.

ITEM #2: (Continued)

2. Exterior Finish:
   -- 26 GA stucco embossed galvanized where unexposed.
   -- 22 GA stucco embossed stainless steel where exposed.

3. Interior Finish:
   -- White .040 stucco embossed aluminum walls.
   -- White acrylic enamel baked-on 26 GA smooth galvanized steel ceiling.

4. Interior Floor:
   -- 4" prefabricated floor panels installed in 6" deep floor recess over hot asphalt paper or 6 MIL polyethylene sheets on building floor slab.
   -- 2" setting bed with two (2) layers of wire reinforcing mesh fabric and epoxy floor material with 6" high integral coved base, interior and exterior of box, installed over prefabricated floor panel by Tile Contractor.

5. Entrance Door:
   -- Two (2) flush-mounted, self-closing doors with 34"x76" net opening. Provide left-hand hinged door for the cooler and right-hand hinged for the freezer.
   -- Polished chrome camlift hinges with lift-off capability. Provide one (1) extra hinge per door, three (3) total.
   -- Kason #1236 polished chrome lever-action handle with knob-turn release and cylinder lock, each door.
   -- Kason #09440004 polished chrome dead-bolt lock, factory mounted.
   -- Kason #109400003 hydraulic door closer.
   -- Standard 2" diameter dial thermometer factory mounted in door frame.
   -- Pilot light and switch assembly factory mounted in door frame with stainless steel coverplate.
   -- 36" high aluminum diamond tread kickplates, interior and exterior, of door, frame and jambs.
   -- 14" x 24" heated observation windows, both doors.
   -- Kason #907 interior door handle, factory mounted with concealed metal backing plate.
   -- Round vinyl door bumper mounted to front exterior face to protect handle from puncturing wall when door in full open position.
   -- Stainless steel heated threshold at each entrance door.
   -- Undercut doors for epoxy floor.
   -- Kason #1806 LED light fixture with high-impact plastic globe factory mounted centered above door opening. Conceal conduit within header of door frame and extend to junction box mounted on top of door panel.
   -- Engraved phenolic plastic compartment sign - 12" long x 2" high; white in color with 1" high blue CAPITAL letters mounted on door above observation window; (1) – FREEZER, (1) COOLER.

6. Heated pressure relief port in freezer compartment.

7. Four (4) Kason #1810L21248LB 48" long twin-tube LED light fixtures with shatter-proof high impact plastic covers centrally-mounted to walk-in ceiling; Two (2) for the freezer, two (2) for the cooler. Provide low-temperature ballast (-20º F.) for freezer lights. Fixtures shipped loose and mounted by K.E.C.; final connection by Electrical Contractor.

8. Modularm Model #75LC recessed digital thermometer with audio-visual temperature alarm factory mounted in each door frame and inter-wired with building monitoring system by Electrical Contractor, as required. Extend temperature probe to rear of compartment mounted at ceiling behind evaporator coil.

9. Provide and install trim strips of matching exterior finish between ends of walk-in panels and building walls from floor to finished ceiling. K.E.C. to verify ceiling height.

ITEM #2: (Continued)

10. Provide and install closure panels of matching exterior finish between top of walk-in and finished ceiling. K.E.C. to verify ceiling height.

11. All electrical conduit shall be run concealed above walk-in ceiling per Detail, Sheet K1.4.

12. Evaporator coil drain lines shall be run to floor drain with P-trap on exterior of box by Plumbing Contractor.

13. Black flexible "Armaflex" insulation applied to exposed drain lines and fittings within interior of box by Refrigeration Contractor.

14. Spiral heat tape applied to drain line within interior of freezer compartment prior to application of insulation by Electrical Contractor. Drain line heating cable shall be installed for continuous 24-hour operation.

15. Coordinate location of sprinkler head drops and provide penetrations, where necessary.

16. Seal and insulate all openings to prevent infiltration of warm air into cooler/freezer compartments.

17. Quality Inspection Requirement:
    -- Walk-In shall be completely erected at the manufacturer's facility prior to shipment and a quality control inspection performed on the assembled structure. A digital photograph of factory assembled walk-in shall be provided for the K.E.C. permanent records and included in the operation and maintenance manuals.

18. Accessories:
    -- One (1) Mars Air LoPro #LPN36-IU air door curtain factory installed above cooler door with optional on/off microswitch. Electrical Contractor to provide power receptacle and final connection. Mount fan centered over walk-in door opening and attach to wall panel with thru-bolts.

ITEM #3: COOLER REFRIGERATION SYSTEM

QUANTITY:	One (1)
MANUFACTURER:	Bally Refrigerated Boxes, Inc.
MODEL NO.:	BQHA015E6-HS2A (N058)
PERTINENT DATA:	Quiet Line-Series, Air Cooled, Outdoor Installation, Remote, With KE2 Therm Demand Defrost Controller
UTILITIES REQ'D:	14.0A, 208V, 1PH
ALTERNATE MFRS.:	Master-Bilt; Coldzone

Furnish and install per Equipment Plan, Sheet K1.1; Manufacturer's Shop Drawing and the following:

1. Condensing Unit: Factory Pre-Assembled, Hermetic, Medium Temperature, R-404A.

2. System located outdoors on roof. Curb with pitch-pocket furnished and installed by Contractor. Refer to Mechanical Roof Plan for exact location.

3. Complete winterization package and condensing unit weatherproof cover.

4. Factory installed air defrost timer with contactors and relays.

5. Overall size: 48⅛" L x 16⅝" W x 29⅜" H.

ITEM #3: (Continued)

6. Weight: 315 lbs.

7. Evaporator Coil with High-Efficiency EC Motors: Low-Profile, End-Mount Type, Model BLP214MA-S2B_ECM; 1.4A, 120V, 1PH
   -- System to operate at +35° F.
   -- KE2 Therm Demand Defrost Electronic Controller with remote monitoring and diagnostics consisting of a microprocessor driven controller, sensors and an optional Electronic Expansion Valve (EEV) factory-installed. Electrical Contractor to field install control wiring between KE2 Therm Controller and Modularm 75LC door monitor. See wiring diagram, Sheet K1.4.

9. Complete refrigeration system warrantee: five (5) years for the compressor, Two (2) years for the condensing unit, and Two (2) years for all parts of the evaporator coil.

10. Factory installed main-fused disconnect switch.

ITEM #4: FREEZER REFRIGERATION SYSTEM

QUANTITY:	One (1)
MANUFACTURER:	Bally Refrigerated Boxes, Inc.
MODEL NO.:	BQHA025L6-HS2A (N058)
PERTINENT DATA:	Quiet Line-Series, Air Cooled, Outdoor Installation, Remote, With KE2 Therm Demand Defrost Controller
UTILITIES REQ'D:	20.5A, 208V, 1PH
ALTERNATE MFRS.:	Master-Bilt; Coldzone

Furnish and install per Equipment Plan, Sheet K1.1; Manufacturer's Shop Drawing and the following:

1. Condensing Unit: Factory Pre-Assembled, Hermetic, Low Temperature, R-404A.

2. System located outdoors on roof. Curb with pitch-pocket furnished and installed by Contractor. Refer to Mechanical Roof Plan for exact location.

3. Complete winterization package and condensing unit weatherproof cover.

4. Factory installed electric defrost timer with contactors and relays.

5. Overall size: 48⅛" L x 16⅝" W x 29⅜" H.

6. Weight: 330 lbs.

7. Evaporator Coil with High-Efficiency EC Motors: Low-Profile, End-Mount Type, Model BLP209LE-S2B_ECM, 1.4A, 208V, 1PH (Fan); 10.3A, 208V, 1PH (Defrost Heater)
   -- System to operate at -10° F.
   -- KE2 Therm Demand Defrost Electronic Controller with remote monitoring and diagnostics consisting of a microprocessor driven controller, sensors and an optional Electronic Expansion Valve (EEV) factory-installed. Electrical Contractor to field install control wiring between KE2 Therm Controller and Modularm 75LC door monitor. See wiring diagram, Sheet K1.4.

8. Complete refrigeration system warrantee: five (5) years for the compressor, Two (2) years for the condensing unit, and Two (2) years for all parts of the evaporator coil.

9. Factory installed main-fused disconnect switch.

ITEM #5: SHELVING, MOBILE

QUANTITY: Seventeen (17)
MANUFACTURER: InterMetro Industries Corporation
MODEL NO.: Super Erecta Pro (N058)
PERTINENT DATA: Open-Grid Shelf Mat, Polymer
UTILITIES REQ'D: ----
ALTERNATE MFRS.: Eagle Group

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

Cooler:

1. Four (4) #PR2142NK3 sections; 21" W x 42" L x 4-tier high.
2. Three (3) #PR2148NK3 sections; 21" W x 48" L x 4-tier high.
3. Twenty-eight (28) #63UPK3 Metroseal 3 epoxy coated posts, 62" high.
4. Fourteen (14) #5MP polyurethane swivel casters with donut bumpers.
5. Fourteen (14) #5MPB polyurethane swivel casters with brakes and donut bumpers.
6. Plastic split sleeves, quantity as required.
7. Locate bottom shelf @ 12" A.F.F.; space remaining shelves equally.

Freezer:

1. Four (4) #PR2136NK3 sections; 21" W x 36" L x 4-tier high.
2. Six (6) #PR2142NK3 sections; 21" W x 42" L x 4-tier high.
3. Forty (40) #63UPK3 Metroseal 3 epoxy coated posts, 62" high.
4. Twenty (20) #5MP polyurethane swivel casters with donut bumpers.
5. Twenty (20) #5MPB polyurethane swivel casters with brakes and donut bumpers.
6. Plastic split sleeves, quantity as required.

ITEM #6: SHELVING

QUANTITY: Twenty-Four (24)
MANUFACTURER: InterMetro Industries Corporation
MODEL NO.: Super Erecta (N058)
PERTINENT DATA: Four-Tier High, Stationary, Chrome-Plated, Wire
UTILITIES REQ'D: ----
ALTERNATE MFRS.: Eagle Group

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

Dry Storage:

1. Five (5) #2436NC sections; 24" W x 36" L x 5-tier high.

ITEM #6: (Continued)

2. Nineteen (19) #2448NC sections; 24" W x 48" L x 5-tier high.

3. Ninety-six (96) #74E chrome posts; 74" high.

4. Plastic split sleeves, quantity as required.

5. Locate bottom shelf @ 12" A.F.F.; space remaining shelves equally.

ITEM #7: DUNNAGE RACK

QUANTITY:	Six (6)
MANUFACTURER:	InterMetro Industries Corporation
MODEL NO.:	Super Erecta
PERTINENT DATA:	With Wire Mat, Chrome-Plated
UTILITIES REQ'D:	----
ALTERNATE MFR.:	Eagle Group

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

Dry Storage:

1. Six (6) #HP55C chrome-plated units; 24" W x 48" L.

ITEM #8: PREP SINK

QUANTITY:	One (1)
MANUFACTURER:	Custom Fabricated
MODEL NO:	#14 GA Stainless Steel
PERTINENT DATA:	7'-6" Long x 2'-6" Wide x 2'-10" High
UTILITIES REQ'D:	1/2" HW, 1/2" CW, (2) 1-1/2" IW
ALTERNATE MFRS	None

Fabricate and set-in-place per Equipment Plan, Sheet K1.1; Fabrication Detail, Sheet K1.5; and the following:

1. Front and end edge rolls per Detail 1.02B.

2. 13" high backsplash per Detail 1.04A. Attach backsplash to wall with fabricator-supplied z-clips.

3. Framework per Detail 1.05.

4. Legs per Detail 1.07.

5. Stainless steel undershelf on both ends per Detail 1.11.

6. Sound-deaden underside of sinks and drainboards with NSF-approved sound dampening material.

7. Accessories:
   -- One (1) T&S #B-0231 backsplash-mounted swing spout faucet with #B-0199-01F-10 aerator.
   -- Two (2) T&S #B-3950-01 twist waste valves with overflow assemblies and #010387-45 basket strainers.

ITEM #8: (Continued)

8. Item will remain shrink-wrapped until ready for final connection by Plumbing Contractor. Immediately following completion of final connections, K.E.C. shall re-shrink-wrap tubs or provide removable panel to avoid use by construction trades. Post sign on wall above sink tubs in English and Spanish stating: WARNING! NOT TO BE USED BY CONSTRUCTION TRADES. FAILURE TO COMPLY WILL RESULT IN $500.00 FINE AND ALL COSTS TO REPLACE ITEM WITH NEW.

ITEM #9: FOOD PROCESSOR

QUANTITY:	One (1)
MANUFACTURER:	Robot Coupe USA, Inc.
MODEL NO.:	R-602V (N058)
PERTINENT DATA:	Continuous Feed Hopper, Dual Purpose, Variable Speed, 7-Qt. Bowl
UTILITIES REQ'D:	15.0A, 120V, 1PH
ALTERNATE MFRS.:	None

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Standard food processor package consisting of: food processor, 7-qt. stainless steel bowl, continuous feed vegetable preparation attachment, (1) #28058 1/8" grating disc and (1) #28064 1/8" slicing disc.

2. Accessories:
   -- One (1) #101230 wall mount disc rack.

3. Cord and plug set.

ITEM #10: ICE MACHINE/BIN

QUANTITY:	One (1)
MANUFACTURER:	Scotsman
MODEL NO.:	C0522SA-1/B322S (N058)
PERTINENT DATA:	Air-Cooled, 475-LB. Maker, 370-LB. Bin, Half-Dice Cubes, LEED Compliant
UTILITIES REQ'D:	13.8A, 120V, 1PH; 1/2" CW, 1/2" IW (Maker Drain), 3/4" IW (Bin Drain)
ALTERNATE MFRS.:	None

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Stainless steel exterior finish, ice machine and bin.

2. Accessories:
   -- One (1) Everpure #EV9324-21 InsurIce 2000 Single water filter system with Coarse Filter factory assembled to common wall rack.
   -- 6" high stainless steel legs with adjustable bullet feet.
   -- Custom fabricated stainless steel ice scoop holder mounted to right-hand side of bin per Detail Sheet K1.5.

3. Cord and plug with matching receptacle furnished and installed by Electrical Contractor.

ITEM #11: HAND SINK

QUANTITY:	Five (5)
MANUFACTURER:	Eagle Foodservice Equipment Company
MODEL NO.:	HSA-10-FAW-LRS (N058)
PERTINENT DATA:	Wall Mounted Assembly, With Wrist-Action Handles
UTILITIES REQ'D:	1/2" HW, 1/2" CW, 1-1/2" W
ALTERNATE MFRS.:	Advance/Tabco; Select Stainless

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Complete sink assembly consisting of: gooseneck faucet, p-trap, tailpiece and basket drain.

2. Accessories:
   -- #606215 skirt assembly.
   -- Left and right end splashes.

ITEM #12: SOAP & TOWEL DISPENSER

QUANTITY:	Five (5)
MANUFACTURER:	Bobrick Washroom Equipment, Inc.
MODEL NO.:	B-5050/B-262 (N058)
PERTINENT DATA:	Surface Wall Mounted, Stainless Steel Finish (400) C-Fold Capacity
UTILITIES REQ'D:	----
ALTERNATE MFRS.:	None

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Mount units above each hand sink and seal perimeter to wall.

ITEM #13: SLICER

QUANTITY:	One (1)
MANUFACTURER:	Globe Food Equipment Company
MODEL NO.:	3850N (N058)
PERTINENT DATA:	Automatic 2-Speed Carriage Drive, 13" Diameter Blade
UTILITIES REQ'D:	1/2 HP, 120V, 1PH
ALTERNATE MFRS.:	None

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Accessories:
   -- One (1) #1326 adjustable high fence.
   -- One (1) #1047 adjustable low fence.
   -- One (1) #LONGCHUTE food chute.
   -- One (1) #699-BAS vegetable hopper.

2. Cord and plug set.

ITEM # 14: WORKTABLE

QUANTITY:	One (1)
MANUFACTURER:	Custom Fabricated
MODEL NO.:	#14 GA Stainless Steel
PERTINENT DATA:	6'-0" Long x 2'-6" Wide x 3'-0" High
UTILITIES REQ'D:	----
ALTERNATE MFRS.:	None

Fabricate and set-in-place per Equipment Plan, Sheet K1.1; Fabrication Detail, Sheet K1.5; and the following:

1. Front and end edge roll per Detail 1.02M.

2. 6" high backsplash per Detail 1.04A. Attach backsplash to wall with fabricator-supplied z-clips.

3. Framework per Detail 1.05.

4. Legs per Detail 1.07.

5. Stainless steel undershelf per Detail 1.11.

6. One (1) stainless steel drawer assembly per Detail 1.14, Type I, with lock.

7. Worktable per Detail 2.01.

8. Sound-deaden underside of tabletop with NSF-approved sound dampening material.

ITEM #15: UTILITY RACEWAY

QUANTITY:	One (1)
MANUFACTURER:	Captive-Aire Systems, Inc.
MODEL NO.:	UDI (N058)
PERTINENT DATA:	Wall Mounted
UTILITIES REQ'D:	125A, 120/208V, 3PH; 3/4"HW, 3/4" CW; 1-1/2" Natural Gas @ 1,100MBH (Looped Service)
ALTERNATE MFRS.:	Avtec; Gaylord

Furnish and install per Equipment Plan, Sheet K1.1; Utility Raceway Details, Sheet K1.6; Manufacturer's Shop Drawing and the following:

1. All components and labor necessary for a complete system manufactured in accordance with NEC latest edition, NEMA, NFPA No. 96 and No. 54, Uniform Plumbing Code, ASME, OSHA using only U.L. Listed certified components.

2. 21'-6" long x 12" wide x 6'-8" high with risers, completely pre-wired and pre-plumbed to one final connection point for electric, gas, hot water and cold water. All connections shall face down on horizontal member.

3. System shall extend up to bottom edge of Ventilator, Item #16.

4. 4'-7" overall height less risers with peaked top.

5. 36" long x 12" wide x 6'-10" high risers on each end with 2" penetration into ventilator at 6'-8" A.F.F.

ITEM #15: (Continued)

6. Entire raceway shall be constructed of #16 gauge Type 304 stainless steel with a #4 mill finish.

7. Removable link plates constructed of #16 gauge stainless steel.

8. Electrical compartment shall be completely enclosed with stainless steel housing accessible by the removal of link plates. Internal electrical feeder shall be conductor cable wireway having balanced load and phases and with connection lugs for main service. Branch circuit wiring for each electrical connection shall be phase identified and sized in accordance with circuit breaker rated capacity. Raceway shall provide electrical, gas and water service for items #17, #18, #21, #23 and #24.

9. Provide 12" long interchangeable 16 gauge stainless steel link connection plate for each electrical connection wired to electrical load center in riser end with individual circuit breaker(s) and grounding type receptacle with twist-lock feature or pre-wired flexible sealtite conduit.

10. On each connection plate provide U.L. listed GFIC ground fault interrupter circuits and matching power supply cords on each 120-volt single-phase connection.

11. Hot water and cold water plumbing compartment shall be isolated from electrical compartment. All piping and disconnects in system shall be color coded.

12. All hot and cold water piping, including individual branch pipe connection, shall be hard temper type "L" copper tubing with copper sweat type solder fittings. At each individual connection, provide A.G.A approved flexible hose(s) with two wall brass and stainless steel construction with quick-disconnect fittings.

13. At each individual gas branch connection, provide 1/4-turn ball valve and 48" long Dormont PVC coated AGA and NSF approved flexible hose with SnapFast quick-disconnect device and double SwivelMAX gas connectors.

14. Provide fire/fuel shut-off for electric equipment per NFPA No. 96. System shall require one final connection by Contractor from fire protection system.

15. Provide matching cord sets for all electric equipment, six (6) total.

16. Neoprene bumper strips, full length.

17. Provide each mobile piece of equipment with an A.G.A. recognized restraining device protecting respective gas disconnect assemblies and connectors.

18. Factory mounted pre-piped gas solenoid valves at each incoming gas service.

19. U.L. listed, solid-state control panel mounted in right-hand riser end, with the following integral accessories:
    -- Ventilator start/stop station with adjustable time-delay to exhaust residual heat.
    -- Ventilator light switch, pre-wired in 10ft. flexible conduit ready for connection to light junction box in ventilator by Electrical Contractor.

20. Accessories:
    -- One (1) Everpure #EV9797-22 Kleen-Steam II twin water filter system factory-installed and housed within left-hand riser. Provide independent pre-piped water line to service points for Item #24: Convection Oven. Fabricate 18"x18" lexan viewport in riser panel to monitor pressure gauge and filter bowl.

21. Fabricated in three (3) sections, assembled in field to present integral one-piece appearance.

ITEM #15: (Continued)

22. Main electrical shunt-type circuit breakers mounted in left-hand riser for 125A, 120/208V, 3PH service.

23. Factory System Design Verification (SDV) shall be performed after all inspections are complete. SDV report shall be available once completed.

24. Raceway shall be of same manufacturer as Ventilator, Item #16.

ITEM #16: VENTILATOR

QUANTITY:	One (1)
MANUFACTURER:	Captive-Aire Systems, Inc.
MODEL NO.:	6030ND-2-ACPSP-F (N058)
PERTINENT DATA:	Wall Mounted, Captrate Solo Filter Type, Perforated Ceiling Make-up Air Plenum with AC-PSP Accessory, With Demand Control Ventilation (DCV) System & Fire Protection System
UTILITIES REQ'D:	4,712 CFM Exhaust, 3,775 CFM Supply (Tempered), 1,446 CFM (AC); 800W, 120V, 1PH (Lights)
ALTERNATE MFR.:	Avtec; Gaylord

Furnish and install per Equipment Plan, Sheet K1.1; Ventilator Detail Drawing, Sheet K1.7; Manufacturer's Instructions and the following:

1. 5'-0" Wide x 21'-6" Long x 2'-6" High, with bottom edge mounted at 6'-8" A.F.F. Length comprised of two (2) 10'-9" section. Entire unit constructed of 18 GA stainless steel with liquid tight all welded external continuous seams and joints per N.F.P.A. 96, U.L. and State of Maryland Codes.

2. Four (4) U.L. Listed, NSF-Approved, 48" long twin-tube recessed LED light fixtures, two (2) equally spaced each section. Bulbs furnished and installed by K.E.C.

3. Matching stainless steel perimeter closure panels to finished ceiling; K.E.C. to verify ceiling height.

4. Surface fire protection system nozzles and piping to be factory installed, chrome plated or stainless steel where exposed, ready for final connections by fire protection system sub-contractor.

5. Hanger rods and support system from structure above by General Contractor. K.E.C. to coordinate method and location with other trades.

6. Stainless steel hanger brackets.

7. 12" wide stainless steel angle framing and closure panels to accommodate Utility Raceway, Item #15.

8. Full-length, perforated stainless steel ceiling-mounted make-up air plenum with integral supply air balancing dampers and AC-PSP accessory for each hood section.

9. Stainless steel captrate solo U.L. Classified high-efficiency grease filters.

10. Semi-concealed stainless steel grease trough sloped to removable grease cups.

11. Factory System Design Verification (SDV) shall be performed after all inspections are complete. SDV report shall be available once completed.

ITEM #16: (Continued)

12. Ventilator shall be of same manufacturer as Utility Raceway, Item #15.

13. Accessories:
    -- 12" wide utility cabinet mounted on right end of hood with factory pre-piped Ansul R-102 fire suppression system and U.L. Listed pre-wired electrical package #DCV-1111-7D with light switches, fan control switches, and internal factory wiring and components to reduce field wiring requirements.
    -- One (1) Ansul Model K01-2 hand-held fire extinguisher, 1.6 gallon, wall-mounted.

ITEM #17: FRYER ASSEMBLY, MOBILE

QUANTITY:	One (1)
MANUFACTURER:	Frymaster Corporation
MODEL NO.:	MJ35E-BLSC (N058)
PERTINENT DATA:	40-Pound Capacity, Full Pot, With Basket Lifts
UTILITIES REQ'D:	4.0A, 120V, 1PH (Controls); 9.0A, 120V, 1PH (Filter); 3/4" Natural Gas @ 110 MBH
ALTERNATE MFRS.:	Pitco

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Stainless steel pot, door, and cabinet sides.

2. Timed-controlled automatic basket lifters.

3. Accessories:
    -- One (1) #806-3068 full-pot covers.
    -- One (1) #823-1885 top connecting strip.
    -- One (1) #803-0103 full-pot sediment tray.
    -- Two (2) #803-0271 twin-size baskets.
    -- Heavy-duty 5" diameter swivel casters, front (2) with brakes.
    -- Built-in filtration system.
    -- One (1) #PSDU50 shortening disposal unit.

4. Mechanical & electrical services provided thru Utility Raceway, Item #15.

ITEM #18: TILTING SKILLET, 30-GALLON

QUANTITY:	One (1)
MANUFACTURER:	Cleveland Range, Inc.
MODEL NO.:	SGL-30-T1 (N058)
PERTINENT DATA:	Power Pan Series, 35" Rim Height
UTILITIES REQ'D:	1.4A, 120V, 1PH; 1/2" HW, 1/2" CW, 2" IW; ¾" Natural Gas @ 125 MBH
ALTERNATE MFRS.:	Groen

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Accessories:
    -- One (1) #DPS13 double pantry faucet with bracket.
    -- One (1) #FSSK-30 food strainer.
    -- One (1) #PT2 power tilt with hand tilt override.

ITEM #18: (Continued)

-- One (1) #TD2SK 2" tangent draw-off valve.

2. Mechanical & electrical services provided thru Utility Raceway, Item #15.

ITEM #19: FLOOR TROUGH

QUANTITY: One (1)
MANUFACTURER: IMC Teddy Foodservice Corporation
MODEL NO.: ASFT2430-SG (N058)
PERTINENT DATA: Anti-Spill, 14 GA S/S
UTILITIES REQ'D: 4" W
ALTERNATE MFRS.: None

Furnish and install per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. 2'-6" long x 2'-0" wide, constructed and installed per Detail, Sheet K1.2.

2. SGAS-24 anti-slip stainless steel subway style removable floor grate in equal sections, the lessor of 30 lbs. and/or 20" long.

3. Bottom of trough pitched to integral stainless steel waste cup with removable perforated stainless steel basket.

4. Top of trough installed flush with top of kitchen finished floor.

5. Unit furnished by K.E.C.; installed by Plumbing Contractor.

ITEM #20: CONVECTION OVEN, MOBILE

QUANTITY: One (1)
MANUFACTURER: Blodgett Oven Company, Inc.
MODEL NO.: ZEPHAIRE-100-E-DOUBLE (N058)
PERTINENT DATA: Double Section, Standard Depth, Solid State Manual Control With Timer
UTILITIES REQ'D: (2)11KW, 208V, 3PH; (2)3/4" CW, (2)1" IW
ALTERNATE MFRS: None

Furnish and set-in-place per Equipment Plan, Sheet K1.1, Manufacturer's Instructions and the following:

1. Standard compliment of wire racks, five (5) per section.

2. Doors with dual pane thermal windows and interior light package.

3. Accessories:
   -- Stainless steel front, both sides, top and solid back panels.
   -- Four (4) heavy-duty 5" diameter polyurethane swivel casters, front two (2) with brakes.

4. Cord and plug sets.

5. Mechanical and electrical services supplied through Utility Raceway, Item #15.

ITEM #21: TILTING KETTLE, 25-GALLON

QUANTITY: One (1)
MANUFACTURER: Cleveland Range, Inc.
MODEL NO.: KGL-25-T (N058)
PERTINENT DATA: Tri-Leg, Self-Contained, 2/3-Jacketed
UTILITIES REQ'D: 10.0A, 120V, 1PH; ½" HW, ½" CW, 2" IW; ¾" Natural Gas @ 90 MBH
ALTERNATE MFRS.: Groen

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Accessories:
   -- One (1) #TD-2 tangent draw-off valve.
   -- One (1) #KAK-25 complete kettle accessory kit.
   -- One (1) #PCK pan carrier.
   -- One (1) #FS food strainer.
   -- One (1) #CHS-25 spring-assisted domed stainless steel cover.
   -- One (1) #MS-25 gallon measuring strip.
   -- One (1) #DPKT double pantry faucet with swing spout and bracket.

2. Electrical and mechanical services supplied through Utility Raceway, Item #15.

ITEM #22: FLOOR TROUGH

QUANTITY: One (1)
MANUFACTURER: IMC Teddy Foodservice Corporation
MODEL NO.: ASFT2130-SG (N058)
PERTINENT DATA: Anti-Spill, 14 GA S/S
UTILITIES REQ'D: 4" W
ALTERNATE MFRS.: None

Furnish and install per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. 2'-6" long x 1'-9" wide, constructed and installed per Detail, Sheet K1.2.

2. SGAS-21 anti-slip stainless steel subway style removable floor grate in equal sections, the lessor of 30 lbs. and/or 20" long.

3. Bottom of trough pitched to integral stainless steel waste cup with removable perforated stainless steel basket.

4. Top of trough installed flush with top of kitchen finished floor.

5. Unit furnished by K.E.C.; installed by Plumbing Contractor.

ITEM #23: RANGE/OVEN, MOBILE

QUANTITY: One (1)
MODEL NO.: MST43R-E (N058)
PERTINENT DATA: Heavy-Duty, Standard Oven Base, (6) Open Burners, Master Sentry Series, Electronic Ignition, Flame Failure Protection
UTILITIES REQ'D: 3.4A, 120V, 1PH; 1-1/4” Natural Gas @ 184MBH
ALTERNATE MFRS.: None

ITEM #23: (Continued)

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Accessories:
   -- Four (4) heavy-duty 5" diameter polyurethane swivel casters, front two (2) with brakes.
   -- Stainless steel front and both sides.
   -- ¾" rear gas connection. Cap and cover manifold ends.
   -- 10" low-profile backguard.
   -- Pressure regulator.

2. Electrical and mechanical services supplied through Utility Raceway, Item #15.

ITEM #24: CONVECTION OVEN, MOBILE

QUANTITY:	One (1)
MANUFACTURER:	Blodgett Oven Company, Inc.
MODEL NO.:	HV-100G-DOUBLE (N058)
PERTINENT DATA:	Double Section, Standard Depth, HydroVection™
UTILITIES REQ'D:	(2)10.0A, 120V, 1PH; (2)3/4" CW, (2)1" IW; (2)3/4" Natural Gas @ 60 MBH
ALTERNATE MFRS:	None

Furnish and set-in-place per Equipment Plan, Sheet K1.1, Manufacturer's Instructions and the following:

1. Accessories:
   -- MenuSelect control with core probe.
   -- Stacking kit.
   -- Ten (10) multi-purpose fry pans.
   -- Five (5) additional stainless steel wire racks.
   -- One (1) Everpure #EV9797-22 KleenSteam II Twin System Water Filter. Ship to Utility Raceway manufacturer for factory installation.

2. Approved backflow preventor furnished and installed by Plumbing Contractor.

3. Electrical and mechanical services supplied through Utility Raceway, Item #15.

ITEM # 25: PAN RACK CART, MOBILE

QUANTITY:	Two (2)
MANUFACTURER:	CresCor
MODEL NO.:	207-UA-13A (N058)
PERTINENT DATA:	Universal Angles, Channel Posts, (13) 18x26 Pan Capacity
UTILITIES REQ'D:	----
ALTERNATE MFR:	InterMetro; Lakeside

Furnish and set-in-place per Equipment Plan, Sheet K1.1, Manufacturer's Instructions and the following:

1. Accessories:
   -- Full perimeter non-marking wrap-around vinyl bumper.

ITEM #26: MIXER, 30-QUART

QUANTITY:	One (1)
MANUFACTURER:	Globe
MODEL NO.:	SP30 (N058)
PERTINENT DATA:	Floor Model, With Stainless Steel Removable Bowl Guard & Built-In Ingredient Chute
UTILITIES REQ'D:	3/4 HP, 120V, 1PH
ALTERNATE MFR.:	Varimixer; Hobart

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Standard accessory package consisting of: 30-qt. stainless steel bowl, 30-qt. aluminum flat beater, aluminum dough hook and 30-qt. stainless steel wire whip.

2. Cord and plug set.

ITEM #27: WORKTABLE WITH SINK

QUANTITY:	One (1)
MANUFACTURER:	Custom Fabricated
MODEL NO.:	#14 GA Stainless Steel
PERTINENT DATA:	14'-6" Long x 2'-6" Wide x 3'-0" High
UTILITIES REQ'D:	½" HW, ½" CW, 1-½" IW
ALTERNATE MFRS.:	None

Fabricate and set-in-place per Equipment Plan, Sheet K1.1; Fabrication Detail, Sheet K1.5; and the following:

1. Front and end edge roll per Detail 1.02M.

2. 8" high backsplash per Detail 1.04A with finished back.

3. Framework per Detail 1.05.

4. Legs per Detail 1.07. Flanged feet on each corner leg.

5. Stainless steel undershelf per Detail 1.11.

6. Two (2) stainless steel drawer assemblies per Detail 1.14, Type I, with locks.

7. 10'-0" long table-mounted, single-sided utensil rack per Detail 1.18A.

8. Worktable per Detail 2.01.

9. Two (2) duplex receptacles with stainless steel faceplates mounted within backsplash Pre-wire to junction box mounted below undershelf and conceal wiring within tubular leg.

10. 18" x 18" x 10" deep utility sink per Detail 3.04.

11. Sound-deaden underside of tabletop and sink with NSF-approved sound dampening material.

12. Accessories:
    -- One (1) T&S #B-0321 deck-mounted swivel gooseneck faucet with #B-199-2F-10 aerator.

ITEM #28: REACH-IN REFRIGERATOR, MOBILE

QUANTITY:	One (1)
MANUFACTURER:	True Food Service Equipment
MODEL NO.:	TS-49 (N058)
PERTINENT DATA:	Two-Section, Self-Contained, Stainless Steel Front/Sides & Interior, TS Series
UTILITIES REQ'D:	5.8A, 120V, 1PH
ALTERNATE MFRS.:	Continental; Victory; Delfield

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Full-height doors hinged per Equipment Plan.
2. Cylinder locks, keyed-alike.
3. Standard chrome plated wire shelves; furnish three (3) per compartment, twelve (12) total.
4. Exterior mounted digital thermometer.
5. 5" diameter heavy-duty swivel casters, front two (2) with brakes.
6. Cord and plug set.
7. Stainless steel back.

ITEM # 29: WORKTABLE

QUANTITY:	One (1)
MANUFACTURER:	Custom Fabricated
MODEL NO.:	#14 GA Stainless Steel
PERTINENT DATA:	10'-0" Long x 2'-6" Wide x 3'-0" High
UTILITIES REQ'D:	----
ALTERNATE MFRS.:	None

Fabricate and set-in-place per Equipment Plan, Sheet K1.1; Fabrication Detail, Sheet K1.5; and the following:

1. Front and end edge roll per Detail 1.02M.
2. 6" high backsplash per Detail 1.04A.
3. Framework per Detail 1.05.
4. Legs per Detail 1.07. Flanged feet on each corner leg.
5. Stainless steel undershelf per Detail 1.11.
6. Two (2) stainless steel drawer assemblies per Detail 1.14, Type I, with locks.
7. Worktable per Detail 2.01.
8. 20A, 120V duplex receptacle with stainless steel faceplate mounted to underside of table on each end wired to common junction box located below undershelf. Conceal wiring within tubular leg.

ITEM #29: (Continued)

9. Sound-deaden underside of tabletop with NSF-approved sound dampening material.

ITEM # 30: SPARE NUMBER

ITEM #31: HEATED CABINET, MOBILE

QUANTITY: One (1)
MANUFACTURER: True Food Service Equipment
MODEL NO.: TH-23 (N058)
PERTINENT DATA: TH Series, One-Section, Stainless Steel Front & Interior, Aluminum Sides
UTILITIES REQ'D: 7.8A, 120V, 1PH
ALTERNATE MFRS.: Continental; Victory; Delfield

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Full-height doors hinged per Equipment Plan.
2. Cylinder locks, keyed-alike.
3. Standard chrome plated wire shelves; furnish three (3) per compartment, six (6) total.
4. Exterior mounted digital thermometer.
5. 5" diameter heavy-duty swivel casters, front two (2) with brakes.
6. Cord and plug set.
7. Stainless steel back.

ITEM #32: MILK COOLER, MOBILE

QUANTITY: One (1)
MANUFACTURER: True
MODEL NO.: TMC-58-S-SS (N058)
PERTINENT DATA: 58" Wide, Dual Access, Forced-Air, 16-Crates Capacity
UTILITIES REQ'D: 6.8A, 120V, 1PH
ALTERNATE MFRS.: Continental; Beverage-Air

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Stainless steel exterior and interior.
2. Cord and plug set.
3. Cylinder lid lock.
4. Swivel casters with brakes.
5. Accessories:
   -- #882506 corner bumpers, set of four (4).

ITEM #33: HOT FOOD SERVING COUNTER

QUANTITY: One (1)
MANUFACTURER: Shelleysteel by The Delfield Company
MODEL NO.: Modular Interlocking Sections
PERTINENT DATA: Straight Line Configuration, #14 Gauge S/S Tops
UTILITIES REQ'D: ----
ALTERNATE MFRS.: Low-Temp Industries, Inc.; Director’s Choice by Eagle Group; Randell

Refer to individual counter components listed under alpha headings for specification.

ITEM #33A: SOLID TOP COUNTER

QUANTITY: One (1)
MANUFACTURER: Shelleysteel by The Delfield Company
MODEL NO.: SC-36-NU (N058)
PERTINENT DATA: Open Base, 36" Long
UTILITIES REQ'D: ----
ALTERNATE MFRS.: Low-Temp Industries, Inc.; Director’s Choice by Eagle Group; Randell

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Shop Drawing and the following:

1. (A) - 12" wide full-length solid stainless steel tray slide mounted on rigid brackets.

2. (F) - Line-up interlocks for counter body and tray slide.

3. (V) - 6" high stainless steel legs with adjustable bullet feet.

4. (P) - Open understorage with bottom and intermediate stainless steel shelf.

5. (Q) - 15-amp duplex convenience receptacle mounted in counter apron, server's side.

6. Cord and plug set.

7. Laminate front and exposed ends, color as selected by Architect; K.E.C. to verify.

ITEM #33B: HOT FOOD COUNTER

QUANTITY: One (1)
MANUFACTURER: Shelleysteel by The Delfield Company
MODEL NO.: SH-5-NU (N058)
PERTINENT DATA: Electrically Heated, Open Base, Five (5) Wells With Energy Saving Power
UTILITIES REQ'D: 40.0A, 120/208V, 1PH, 1/2" HW, 3/4" IW
ALTERNATE MFRS.: Low-Temp Industries, Inc.; Director’s Choice by Eagle Group; Randell

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Shop Drawing and the following:

1. (A) - 12" wide full-length solid stainless steel tray slide mounted on rigid brackets.

2. (E) - 8" wide full-length fold-down stainless steel plate shelf on server's side.

ITEM #33B: (Continued)

3. (G) - Sloped front food protector with adjustable tempered glass sneeze guards for full or self-service front and fixed end panels.

4. (M) - Radiant heat lamp with incandescent lights and on/off switch.

5. (F) - Line-up interlocks for counter body and tray slide.

6. (QQ) - Food wells with individual drains and quarter-turn ball valves piped independently to isolated compartment within counter base on end with stainless steel hinged access door per Detail, Sheet K1.3.

7. (V) - 6" high stainless steel legs with adjustable bullet feet.

8. (P) - Open understorage with bottom stainless steel shelf.

9. U.L. Listed straight blade cord and plug set.

10. Laminate front and exposed ends, color as selected by Architect; K.E.C. to verify.

11. Accessories:
    -- One (1) T&S #B-0101-A60 pre-rinse spray valve with aerator and 60" long flexible hose mounted on end. Furnish counter top with stainless steel escutcheon plate to hold pre-rinse spray.

ITEM #33C: COLD FOOD COUNTER

QUANTITY:	One (1)
MANUFACTURER:	Shelleysteel by The Delfield Company
MODEL NO.:	SCSC-50-B (N058)
PERTINENT DATA:	Mechanically Refrigerated Cold Pan, Open Base
UTILITIES REQ'D:	7.0A, 120V, 1PH; 3/4" IW
ALTERNATE MFRS.:	Low-Temp Industries, Inc.; Director’s Choice by Eagle Group; Randell

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Shop Drawing and the following:

1. (A) - 12" wide full-length solid stainless steel tray slide mounted on rigid brackets.

2. (H) - Two-tier display stand with glass shelves end panels and adjustable glass sneezeguards.

3. (L) - Fluorescent light fixtures, each tier.

4. (F) - Line-up interlock for counter body and trayslide.

5. (P) - Open understorage with bottom stainless steel shelf.

6. Laminate front and exposed ends, color as selected by Architect; K.E.C. to verify.

7. (V) - 6" high stainless steel legs with adjustable bullet feet.

8. Cord and plug set.

ITEM #33C: (Continued)

9. Quarter-turn ball shut-off valve in lieu of a hose-bibb. Plumber to sweat pipe connection to nearest floor sink.

ITEM #33D: SOLID TOP COUNTER

QUANTITY:	One (1)
MANUFACTURER:	Shelleysteel by The Delfield Company
MODEL NO.:	SC-50-NU (N058)
PERTINENT DATA:	Open Base, 50" Long
UTILITIES REQ'D:	----
ALTERNATE MFRS.:	Low-Temp Industries, Inc.; Director’s Choice by Eagle Group; Randell

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Shop Drawing and the following:

1. (A) - 12" wide full-length solid stainless steel tray slide mounted on rigid brackets.

2. (F) - Line-up interlocks for counter body and tray slide.

3. (V) - 6" high stainless steel legs with adjustable bullet feet.

4. (P) - Open understorage with bottom and intermediate stainless steel shelf.

5. (Q) - 15-amp duplex convenience receptacle mounted in counter apron, server's side.

6. Cord and plug set.

7. Laminate front and exposed ends, color as selected by Architect; K.E.C. to verify.

ITEM #34: WORKTABLE

QUANTITY:	One (1)
MANUFACTURER:	Custom Fabricated
MODEL NO.:	#14 GA Stainless Steel
PERTINENT DATA:	6'-0" Long x 2'-6" Wide x 3'-0" High
UTILITIES REQ'D:	----
ALTERNATE MFRS.:	None

Fabricate and set-in-place per Equipment Plan, Sheet K1.1; Fabrication Detail, Sheet K1.5; and the following:

1. Front and end edge roll per Detail 1.02M.

2. 6" high backsplash per Detail 1.04A. Attach backsplash to wall with fabricator-supplied z-clips.

3. Framework per Detail 1.05.

4. Legs per Detail 1.07.

5. Stainless steel undershelf per Detail 1.11.

6. One (1) stainless steel drawer assembly per Detail 1.14, Type I, with lock.

ITEM #34: (Continued)

7. Worktable per Detail 2.01.

8. Sound-deaden underside of tabletop with NSF-approved sound dampening material.

ITEM #35: ROLLING DOOR -- (N.I.K.E.C. - SPECIFIED BY ARCHITECT)

QUANTITY: One (1)

ITEM #36: TRASH CONTAINER, MOBILE

QUANTITY: Two (2)
MANUFACTURER: Rubbermaid Commercial Products, Inc.
MODEL NO.: 2632 (N058)
PERTINENT DATA: 32-Gallon Capacity
UTILITIES REQ'D: ----
ALTERNATE MFRS.: Continental Plastics

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Grey in color.

2. Accessories:
   -- Two (2) #2631 matching flat lids.
   -- Two (2) #2640 conversion dollies.

ITEM #37: SOILED DISHTABLE

QUANTITY: One (1)
MANUFACTURER: Custom Fabricated
MODEL NO.: #14 GA Stainless Steel
PERTINENT DATA: "L"-Shaped Configuration, 10'-2"± x 6'-0" Long x 2'-6" Wide x 2'-10" High
UTILITIES REQ'D: 1/2" HW, 1/2" CW, 1-1/2" IW
ALTERNATE MFRS.: None

Fabricate and set-in-place per Equipment Plan, Sheet K1.1; Fabrication Detail Sheet K1.5; and the following:

1. Front edge roll per Detail 1.02B.

2. 13" high back and right end splash per Detail 1.04A. Attach backsplash to wall with fabricator-supplied z-clips.

3. Framework per Detail 1.05.

4. Legs per Detail 1.07.

5. Crossbracing per Detail 1.10.

6. Soiled dishtable per Detail 2.02.

ITEM #37: (Continued)

7. 20" wide x 8" deep integral pre-rinse sink with one-piece removable #20 gauge perforated stainless steel scrap basket with 1" diameter fully welded tubular cross-rails set flush with tabletop. Raise deck at rear of sink 6" for deck-mounted pre-rinse spray and extend to opening of dishmachine to act as rack guide.

8. Provide stainless steel crossrails under pass-thru windows for storage of 20"x20" dish/glass racks.

9. Sound-deaden underside of sink and drainboard with NSF-approved sound dampening material.

10. Accessories:
    -- One (1) T&S #B-0113-BJ deck-mounted pre-rinse spray with built-in back flow preventer and #B-0109 wall bracket.
    -- One (1) Component Hardware #D63-4161 box pattern drain assembly welded to underside of pre-rinse sink.

ITEM #38: SPARE NUMBER

ITEM #39: DISHMACHINE

QUANTITY:	One (1)
MANUFACTURER:	Meiko
MODEL NO:	K-66ET (N058)
PERTINENT DATA:	Fully Automatic Rack-Type, Power Wash, 180° F Final Rinse
UTILITIES REQ'D:	28.4A, 480V, 3PH; 28.8KW, 480V, 3PH (Booster Heater); 1/2" HW (180°F.), 1/2" CW (Drain Cooling Kit), 3" IW
ALTERNATE MFRS.:	Hobart Corporation; Jackson

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Soap dispensing system and rinse additive system by soap chemical vendor.

2. Stainless steel feet, frame, legs and front panel.

3. Common drain manifold and tank fill.

4. Automatic fill with safety switch at drain valve handle.

5. Energy savings auto-timer control package with table-limit switch.

6. Electric tank heat.

7. Right-to-left operation.

8. Vent fan control.

9. Accessories:
    -- Two (2) 4"x16" extended vent hoods with locking damper.
    -- Two (2) open-end 20"x20" racks for 18"x26" sheet pans.
    -- Six (6) #MPR peg-type, and four (4) #MCR combination-type 20"x20" plastic racks
    -- Two (2) stainless steel splash shields.
    -- One (1) drain water tempering kit.

ITEM #39: (Continued)

-- One (1) table limit switch.
-- One (1) built-in booster heater.
-- One (1 water hammer arrestor kit.
-- One (1) stainless steel frame with 6" extended height chamber.

ITEM #40: SILVER SOAK SINK, MOBILE

QUANTITY: One (1)
MANUFACTURER: Eagle Group
MODEL NO.: MSS2020SC (N058)
PERTINENT DATA: 8" Deep, Stainless Steel Construction, With Chute
UTILITIES REQ'D: 1-1/2" IW
ALTERNATE MFRS.: Advance Tabco

Furnish and set-in-place per Equipment Plan, Sheet K1.1 and Manufacturer's Instructions.

ITEM #41: VENT DUCT

QUANTITY: Two (2)
MANUFACTURER: Custom Fabricated
MODEL NO.: Stainless Steel
PERTINENT DATA: ----
UTILITIES REQ'D: 300 CFM (Load End), 600 CFM (Unload End)
ALTERNATE MFRS.: None

Fabricate and install per Equipment Plan, Sheet K1.1; and the following:

1. Constructed and installed per Detail 5.06.

ITEM #42: CLEAN DISHTABLE

QUANTITY: One (1)
MANUFACTURER: Custom Fabricated
MODEL NO.: #14 Gauge Stainless Steel Construction
PERTINENT DATA: 7'-0" L x 2'-6" W x 2'-10" H
UTILITIES REQ'D: ----
ALTERNATE MFRS.: None

Fabricate and set-in-place per Equipment Plan, Sheet K1.1; Fabrication Detail, Sheet K1.5; and the following:

1. Front and left end edge roll per Detail 1.02B.

2. 13" high backsplash per Detail 1.04A. Attach backsplash to wall with fabricator-supplied z-clips.

3. Framework per Detail 1.05.

4. Legs per Detail 1.07.

5. Undershelf per Detail 1.11.

ITEM #42: (Continued)

6. 6'-0" long, table-mounted stainless steel overshelf per Detail 1.12.

7. Dishtable per Detail 2.02.

8. Sound deaden underside of drainboard with NSF-approved sound dampening material.

9. Install table limit switch (supplied with Dishmachine, Item #39) in end of dishtable, inter-wired by Electrical Contractor.

ITEM #43: POT WASHING SINK

QUANTITY:	One (1)
MANUFACTURER:	Custom Fabricated
MODEL NO.:	#14 GA Stainless Steel
PERTINENT DATA:	11'-0" Long x 2'-6" Wide x 2'-10" High
UTILITIES REQ'D:	(2) 3/4" HW, (2) 3/4" CW, (3) 2" IW
ALTERNATE MFR.:	None

Fabricate and set-in-place per Equipment Plan, Sheet K1.1; Fabrication Detail, Sheet K1.5; and the following:

1. Front and end edge rolls per Detail 1.02B.

2. 13" high backsplash per Detail 1.04A. Attach backsplash to wall with fabricator-supplied z-clips.

3. Framework per Detail 1.05.

4. Legs per Detail 1.07.

5. Stainless steel undershelf on both ends per Detail 1.11.

6. Pot sink and drainboards per Detail 3.01.

7. Sound-deaden underside of sinks and drainboards with NSF-approved sound dampening material.

8. Accessories:
   -- Two (2) T&S #B-290 backsplash mounted swing spout faucets.
   -- Three (3) T&S #B-3950-01 twist waste valves with overflow assemblies and #010387-45 basket strainers .

9. Item will remain shrink-wrapped until ready for final connection by Plumbing Contractor. Immediately following completion of final connections, K.E.C. shall re-shrink-wrap tubs or provide removable panel to avoid use by construction trades. Post sign on wall above sink tubs in English and Spanish stating: WARNING! NOT TO BE USED BY CONSTRUCTION TRADES. FAILURE TO COMPLY WILL RESULT IN $500.00 FINE AND ALL COSTS TO REPLACE ITEM WITH NEW.

ITEM #44: POT & PAN SHELVING, MOBILE

QUANTITY:	Two (2)
MANUFACTURER:	InterMetro Industries Corporation
MODEL NO.:	Super Erecta (N058)
PERTINENT DATA:	Four-Tier High, Stainless Steel, Louvered/Embossed
UTILITIES REQ'D:	----
ALTERNATE MFRS.:	Eagle Group

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Two (2) #2448LS sections, 24" W x 48" L x 4-tier high.
2. Eight (8) #63UPS stainless posts for stem casters, 63" high.
3. Four (4) #5MP polyurethane swivel casters with donut bumpers.
4. Four (4) #5MPB polyurethane swivel casters with brakes and donut bumpers.
5. Plastic split sleeves, quantity as required.
6. Locate bottom shelf @ 12" A.F.F.; space remaining shelves equally.

ITEM #45: BEVERAGE COUNTER

QUANTITY:	One (1)
MANUFACTURER:	Custom Fabricated
MODEL NO.:	#14 GA Stainless Steel
PERTINENT DATA:	8'-0" Long x 2'-0" Wide x 3'-0" High
UTILITIES REQ'D:	----
ALTERNATE MFR.:	None

Fabricate and set-in-place per Equipment Plan, K1.1; Fabrication Detail, Sheet K3.5; and the following:

1. Front and end edge rolls per Detail 1.02M.
2. 6" high backsplash per Detail 1.04A.
3. Framework per Detail 1.06.
4. Heavy-duty counter legs per Detail 1.08.
5. Workcounter Detail 4.01.
6. Stainless steel hinged doors per Detail 4.26, with locks and plastic laminate finish; color as selected by Architect; K.E.C. to verify.
7. Sound-deaden underside of countertop with NSF-approved sound dampening material.

ITEM #46: COFFEE URN

QUANTITY:	One (1)
MANUFACTURER:	Cecilware Corp.
MODEL NO.:	FE75N (N058)
PERTINENT DATA:	Automatic, Single 3-Gallon Capacity
UTILITIES REQ'D:	26.0A, 120/208V, 1PH; 1/4" CW
ALTERNATE MFR.:	Curtis; Bunn

Furnish and set-in-place per Equipment Plan, Sheet K1.1, Manufacturer's Instructions and the following:

1. Accessories:
   -- One (1) Everpure #EV9272-41 water filter mounted below countertop.

ITEM #47: MICROWAVE OVEN

QUANTITY:	Two (2)
MANUFACTURER:	Sharp
MODEL NO.:	R-22GTF (N058)
PERTINENT DATA:	1200 Watts, Heavy-Duty
UTILITIES REQ'D:	17.0A, 120V, 1PH
ALTERNATE MFR.:	Amana; Panasonic

Furnish and set-in-place per Equipment Plan, Sheet K1.1; Manufacturer's Instructions and the following:

1. Cord and plug set.

MEN'S SERVING LINE

ITEM #S1: HOT FOOD COUNTER

QUANTITY:	One (1)
MANUFACTURER:	Shelleysteel by The Delfield Company
MODEL NO.:	SH-3-NU (N058)
PERTINENT DATA:	Electrically Heated, Open Base, Three (3) Wells With Energy Saving Power
UTILITIES REQ'D:	20.0A, 120/208V, 1PH, 1/2" HW, 3/4" IW
ALTERNATE MFRS.:	Low-Temp Industries, Inc.; Director's Choice by Eagle Group; Randell

Furnish and set-in-place per Equipment Plan, Sheet K2.1; Manufacturer's Shop Drawing and the following:

1. (A) - 12" wide full-length solid stainless steel tray slide mounted on rigid brackets.

2. (E) - 8" wide full-length fold-down stainless steel plate shelf on server's side.

3. (G) - Sloped front food protector with adjustable tempered glass sneeze guards for full or self-service front and fixed end panels.

4. (M) - Radiant heat lamp with incandescent lights and on/off switch.

5. (F) - Line-up interlocks for counter body and tray slide.

ITEM #S1: (Continued)

6. (QQ) - Food wells with individual drains and quarter-turn ball valves piped independently to isolated compartment within counter base with stainless steel hinged access door per Detail, Sheet K2.2.

7. (V) - 6" high stainless steel legs with adjustable bullet feet.

8. (P) - Open understorage with bottom stainless steel shelf.

9. U.L. Listed straight blade cord and plug set.

10. Laminate front and ends, color as selected by Architect; K.E.C. to verify.

11. Accessories:
    -- One (1) T&S #B-0101-A pre-rinse spray valve with aerator and 60" long flexible hose mounted on end. Furnish counter top with stainless steel escutcheon plate to hold pre-rinse spray.

ITEM #S2: COLD FOOD COUNTER

QUANTITY:	One (1)
MANUFACTURER:	Shelleysteel by The Delfield Company
MODEL NO.:	SCSC-36-B (N058)
PERTINENT DATA:	Mechanically Refrigerated Cold Pan, Open Base
UTILITIES REQ'D:	7.0A, 120V, 1PH; 3/4" IW
ALTERNATE MFRS.:	Low-Temp Industries, Inc.; Director’s Choice by Eagle Group; Randell

Furnish and set-in-place per Equipment Plan, Sheet K2.1; Manufacturer's Shop Drawing and the following:

1. (A) - 12" wide full-length solid stainless steel tray slide mounted on rigid brackets.

2. (H) - Two-tier display stand with glass shelves end panels and adjustable glass sneezeguards.

3. (L) - Fluorescent light fixtures, each tier.

4. (F) - Line-up interlock for counter body and trayslide.

5. (P) - Open understorage with bottom stainless steel shelf.

6. Laminate front and ends, color as selected by Architect; K.E.C. to verify.

7. (V) - 6" high stainless steel legs with adjustable bullet feet.

8. Cord and plug set.

9. Quarter-turn ball shut-off valve in lieu of a hose-bibb. Plumber to sweat pipe connection to nearest floor sink.

ITEM #S3: SOLID TOP COUNTER

QUANTITY: One (1)
MANUFACTURER: Shelleysteel by The Delfield Company
MODEL NO.: SC-50-NU (N058)
PERTINENT DATA: Open Base, 50" Long
UTILITIES REQ'D: ----
ALTERNATE MFRS.: Low-Temp Industries, Inc.; Director's Choice by Eagle Group; Randell

Furnish and set-in-place per Equipment Plan, Sheet K2.1; Manufacturer's Shop Drawing and the following:

1. (A) - 12" wide full-length solid stainless steel tray slide mounted on rigid brackets.

2. (F) - Line-up interlocks for counter body and tray slide.

3. (V) - 6" high stainless steel legs with adjustable bullet feet.

4. (P) - Open understorage with bottom and intermediate stainless steel shelf.

5. (Q) - 15-amp duplex convenience receptacle mounted in counter apron, server's side.

6. Cord and plug set.

7. Laminate front and ends, color as selected by Architect; K.E.C. to verify.

ITEM #S4: COFFEE BREWER

QUANTITY: One (1)
MANUFACTURER: Bunn-O-Matic Corp.
MODEL NO.: Dual SH DBC (N058)
PERTINENT DATA: Automatic, Twin, Soft Heat
UTILITIES REQ'D: 29.1A, 120/208V, 1PH; 1/4" CW
ALTERNATE MFR.: Curtis; Bloomfield; Cecilware

Furnish and set-in-place per Equipment Plan, Sheet K2.1; Manufacturer's Instructions and the following:

1. Accessories:
   -- One (1) #EQHP-10 water filter mounted below countertop.
   -- Two (2) #27850.0001 1½ gallon soft heat servers.

2. Cord and plug set.

ITEM #S5: ICED TEA DISPENSER

QUANTITY: One (1)
MANUFACTURER: Bunn-O-Matic Corp.
MODEL NO: TDS-3-0000 (N058)
PERTINENT DATA: 3-Gallon Capacity
UTILITIES REQ'D: ----
ALTERNATE MFRS.: Grindmaster/Cecilware

Furnish and set-in-place per Equipment Plan, Sheet K2.1 and Manufacturer's Instructions.

ITEM #S6: HEATED/REFRIGERATED CABINET, MOBILE

QUANTITY: One (1)
MANUFACTURER: FWE
MODEL NO.: HF-30 (N058)
PERTINENT DATA: Dual-Temp, (10)18x26 Pan Capacity, Stainless Steel Construction,
UTILITIES REQ'D: 12.0A, 120V, 1PH
ALTERNATE MFRS.: None

Furnish and set-in-place per Equipment Plan, Sheet K2.1; Manufacturer's Instructions and the following:

1. Cord and plug set.

2. Accessories:
   -- Transport latch.
   -- Full-perimeter wrap-around non-marking vinyl bumper.

ITEM #S7: HAND SINK

QUANTITY: One (1)
MANUFACTURER: Eagle Foodservice Equipment Company
MODEL NO.: HSAN-10-FA-LRS (N058)
PERTINENT DATA: Wall Mounted, Space Saver
UTILITIES REQ'D: 1/2" HW, 1/2" CW, 1-1/2" W
ALTERNATE MFRS.: Advance/Tabco; Select Stainless

Furnish and set-in-place per Equipment Plan, Sheet K2.1; Manufacturer's Instructions and the following:

1. Complete sink assembly consisting of: gooseneck faucet, p-trap, tailpiece and basket drain.

2. Accessories:
   -- #607560 skirt assembly.
   -- Left and right end splashes.

ITEM #S8: SOAP & TOWEL DISPENSER

QUANTITY: One (1)
MANUFACTURER: Bobrick Washroom Equipment, Inc.
MODEL NO.: B-5050/B-262 (N058)
PERTINENT DATA: Surface Wall Mounted, Stainless Steel Finish (400) C-Fold Capacity
UTILITIES REQ'D: ----
ALTERNATE MFRS.: None

Furnish and set-in-place per Equipment Plan, Sheet K2.1; Manufacturer's Instructions and the following:

1. Mount units above hand sink and seal perimeter to wall.

THIRD FLOOR KITCHEN

ITEM #T1: SHELVING

QUANTITY: Six (6)
MANUFACTURER: InterMetro Industries Corporation
MODEL NO.: Super Erecta (N058)
PERTINENT DATA: Four-Tier High, Stationary, Chrome-Plated, Wire
UTILITIES REQ'D: ----
ALTERNATE MFRS.: Eagle Group

Furnish and set-in-place per Equipment Plan, Sheet K3.1; Manufacturer's Instructions and the following:

Kitchen Storage:

1. One (1) #2136NC section; 21" W x 36" L x 5-tier high.
2. Two (2) #2142NC sections; 21" W x 42" L x 5-tier high.
3. Two (2) #2148NC sections; 21" W x 48" L x 5-tier high.
4. One (1) #2160NC section; 21" W x 60" L x 5-tier high.
5. Twenty-four (24) #74E chrome posts; 74" high.
6. Plastic split sleeves, quantity as required.
7. Locate bottom shelf @ 12" A.F.F.; space remaining shelves equally.

ITEM #T2: REACH-IN FREEZER, MOBILE

QUANTITY: One (1)
MANUFACTURER: True Food Service Equipment
MODEL NO.: T-23F (N058)
PERTINENT DATA: One-Section, Self-Contained, Stainless Steel Front/Aluminum Sides & Interior, T Series
UTILITIES REQ'D: 7.2A, 120V, 1PH
ALTERNATE MFRS.: Continental; Victory; Delfield

Furnish and set-in-place per Equipment Plan, Sheet K3.1; Manufacturer's Instructions and the following:

1. Full-height door hinged per Equipment Plan.
2. Cylinder locks, keyed-alike.
3. Standard chrome plated wire shelves; furnish three (3) per compartment, six (6) total.
4. Exterior mounted digital thermometer.
5. 5" diameter heavy-duty swivel casters, front two (2) with brakes.
6. Cord and plug set.

ITEM #T3: REACH-IN REFRIGERATOR, MOBILE

QUANTITY:	One (1)
MANUFACTURER:	True Food Service Equipment
MODEL NO.:	T-49 (N058)
PERTINENT DATA:	Two-Section, Self-Contained, Stainless Steel Front/Aluminum Sides & Interior, T Series
UTILITIES REQ'D:	9.1A, 120V, 1PH
ALTERNATE MFRS.:	Continental; Victory; Delfield

Furnish and set-in-place per Equipment Plan, Sheet K3.1; Manufacturer's Instructions and the following:

1. Full-height door hinged per Equipment Plan.

2. Cylinder locks, keyed-alike.

3. Standard chrome plated wire shelves; furnish three (3) per compartment, twelve (12) total.

4. Exterior mounted digital thermometer.

5. 5" diameter heavy-duty swivel casters, front two (2) with brakes.

6. Cord and plug set.

ITEM #T4: PREP SINK

QUANTITY:	One (1)
MANUFACTURER:	Custom Fabricated
MODEL NO:	#14 GA Stainless Steel
PERTINENT DATA:	7'-0" Long x 2'-0" Wide x 2'-10" High
UTILITIES REQ'D:	1/2" HW, 1/2" CW, (2) 1-1/2" IW
ALTERNATE MFRS	None

Fabricate and set-in-place per Equipment Plan, Sheet K3.1; Fabrication Detail, Sheet K3.5; and the following:

1. Perimeter edge rolls per Detail 1.02.1C.

2. Framework per Detail 1.05.

3. Legs per Detail 1.07. Flanged feet on each corner leg.

4. Stainless steel undershelf on both ends per Detail 1.11.

5. Sound-deaden underside of sinks and drainboards with NSF-approved sound dampening material.

6. Accessories:
   -- One (1) T&S #B-0113-BJ pre-rinse spray faucet with #B-156 12" swing-spout add-on faucet, #B-109 wall bracket and backflow preventer.
   -- Two (2) T&S #B-3950-01 twist waste valves with overflow assemblies and #010387-45 basket strainers.

ITEM #T4: (Continued)

7. Item will remain shrink-wrapped until ready for final connection by Plumbing Contractor. Immediately following completion of final connections, K.E.C. shall re-shrink-wrap tubs or provide removable panel to avoid use by construction trades. Post sign on wall above sink tubs in English and Spanish stating: WARNING! NOT TO BE USED BY CONSTRUCTION TRADES. FAILURE TO COMPLY WILL RESULT IN $500.00 FINE AND ALL COSTS TO REPLACE ITEM WITH NEW.

ITEM #T5: WORKTABLE

QUANTITY: One (1)
MANUFACTURER: Custom Fabricated
MODEL NO.: #14 GA Stainless Steel
PERTINENT DATA: 7'-0" Long x 2'-0" Wide x 3'-0" High
UTILITIES REQ'D: ----
ALTERNATE MFRS.: None

Fabricate and set-in-place per Equipment Plan, Sheet K3.1; Fabrication Detail, Sheet K3.5; and the following:

1. Front and end edge rolls per Detail 1.02B.

2. 8" high backsplash per Detail 1.04A with finished back. Flanged feet on each corner leg.

2. Framework per Detail 1.05.

3. Legs per Detail 1.07.

4. Stainless steel undershelf per Detail 1.11.

5. Two (2) stainless steel drawer assemblies per Detail 1.14, Type I with locks.

6. Full-length table-mounted, single-sided utensil rack per Detail 1.18A.

7. Worktable per Detail 2.01.

8. Sound deaden underside of tabletop with NSF-approved sound dampening material.

ITEM #T6: WORKCOUNTER

QUANTITY: One (1)
MANUFACTURER: Custom Fabricated
MODEL NO.: #14 GA Stainless Steel
PERTINENT DATA: L-Shaped: 9'-0" x 5'-6" Long x 2'-0" Wide x 3'-0" High
UTILITIES REQ'D: ----
ALTERNATE MFRS.: None

Fabricate and set-in-place per Equipment Plan, Sheet K3.1; Fabrication Detail, Sheet K3.5; and the following:

1. Front and end edge roll per Detail 1.02M.

2. 6" high backsplash per Detail 1.04A.

ITEM #T6: (Continued)

3. Counter framework per Detail 1.06.

4. Heavy-duty counter legs per Detail 1.08.

5. Workcounter per Detail 4.02.

6. Sound-deaden underside of tabletop with NSF-approved sound dampening material.

ITEM #T7: RANGE/OVEN, MOBILE

QUANTITY:	One (1)
MANUFACTURER:	Garland Commercial Industries, Inc.
MODEL NO.:	GFE36-6R (N058)
PERTINENT DATA:	Standard Oven Base; (6) Open Burners, GFE Restaurant Series, With Electronic Spark Ignition & Flame Failure Protection
UTILITIES REQ'D:	3.4A, 120V, 1PH; 3/4" Natural Gas @ 194 MBH
ALTERNATE MFRS.:	None

Furnish and set-in-place per Equipment Plan, Sheet K3.1; Manufacturer's Instructions and the following:

1. Accessories:
   -- Four (4) heavy-duty 5" diameter polyurethane swivel casters, front two (2) with brakes.
   -- Stainless steel front and both sides.
   -- ¾" rear gas connection. Cap and cover manifold ends.
   -- 10" low-profile backguard.
   -- One (1) Dormont #1675KITCF2S48PS double Super-Swivel Super-Safe gas connector assembly consisting of 48" long hose with Cimfast and A.G.A. approved coiled restraining device.

2. Cord and plug set.

ITEM #T8: CONVECTION OVEN, MOBILE

QUANTITY:	One (1)
MANUFACTURER:	Moffat, Inc.
MODEL NO.:	G32D5/2C (N058)
PERTINENT DATA:	Double Stack, Standard Depth, Full-Size
UTILITIES REQ'D:	(2) 1.0A, 120V, 1PH; 1/2" Natural Gas @ 66 MBH
ALTERNATE MFR.:	None

Furnish and set-in-place per Equipment Plan, Sheet K3.1; Manufacturer's Instructions and the following:

1. Natural gas fired, pressure regulator as required. Manifold rear gas connection of each oven compartment for single connection point ready for quick disconnect assembly.

2. Standard compliment of wire racks, five (5) per section.

3. Doors with dual pane thermal windows and interior light package.

4. Accessories:
   -- Stainless steel front, both sides, top and solid back panels.

ITEM #T8: (Continued)

-- Stacking kit with four (4) heavy-duty 5" diameter polyurethane swivel casters, front two (2) with brakes.
-- One (1) Dormont #1650KITCF2S48PS double Super-Swivel Super-Safe gas connector assembly consisting of 48" long hose with Cimfast and A.G.A. approved coiled restraining device.

5. Cord and plug sets.

ITEM #T9: VENTILATOR

QUANTITY:	One (1)
MANUFACTURER:	Captive-Aire Systems, Inc.
MODEL NO.:	6030ND-2-ACPSP-F (N058)
PERTINENT DATA:	Wall-Mounted, Captrate Solo Filter Type, Perforated Ceiling Make-up Air Plenum with AC-PSP Accessory, With Fire Protection System
UTILITIES REQ'D:	1,912 CFM Exhaust/1,600 CFM Supply/600 CFM (AC); 350W, 120V, 1PH (Lights); 20.0A (Cir), 120V, 1PH (Fire Protection System)
ALTERNATE MFRS.:	Gaylord; Avtec

Furnish and install per Equipment Plan, Sheet K3.1; Ventilator Detail Drawing, Sheet K3.6; Manufacturer's Shop Drawing and the following:

1. 5'-0" Wide x 8'-6" Long x 2'-6" High, with bottom edge mounted at 6'-8" A.F.F. Length comprised of one (1) 8'-6" long section. Entire unit constructed of 18 GA stainless steel with liquid tight all welded external continuous seams and joints per N.F.P.A. 96, U.L. and State of Maryland Codes.

2. Two (2) U.L. Listed, NSF-Approved, 36" long twin-tube recessed LED light fixture. Bulbs furnished and installed by K.E.C.

3. Matching stainless steel perimeter closure panels to finished ceiling; K.E.C. to verify ceiling height.

4. Surface fire protection system nozzles and piping to be factory installed, chrome plated or stainless steel where exposed, ready for final connections by fire protection system sub-contractor.

5. Hanger rods and support system from structure above by Contractor. K.E.C. to coordinate method and location with other trades.

6. Stainless steel hanger brackets.

7. U.L. Classified stainless steel captrate solo filter with hook.

8. 3" wide integral stand-off at rear for semi-combustible compliance.

9. Semi-concealed stainless steel grease trough sloped to removable grease cups.

10. Full-length, perforated stainless steel ceiling-mounted make-up air plenum with integral supply air balancing dampers and AC-PSP accessory.

11. Factory System Design Verification (SDV) shall be performed after all inspections are complete. SDV report shall be available once completed.

ITEM #T9: (Continued)

12. Accessories:
    -- #18GA stainless steel wall flashing from bottom edge of hood to top of finish floor base. Extend full-length of hood body. Attach to wall with non-exposed fasteners.
    -- 12" wide utility cabinet mounted on right end with factory pre-piped Ansul R-102 fire suppression system. and electrical pre-wire package #DCV-1111-7D with light and fan switches.
    -- One (1) Ansul Model K01-2 hand-held fire extinguisher, 1.6 gallon, wall-mounted.

ITEM #T10: CONDENSATE CANOPY

QUANTITY: One (1)
MANUFACTURER: Captive-Aire Systems, Inc.
MODEL NO: 4230VHB-G (N058)
PERTINENT DATA: Stainless Steel, Exhaust Only Canopy
UTILITIES REQ'D: 525 CFM; 3/4" IW
ALTERNATE MFRS.: Avtec; Gaylord

Fabricate and install per Equipment Plan, Sheet K3.1; Canopy Details, Sheet K3.6; and the following:

1. 3'-6" wide x 3'-6" long x 2'-6" high with bottom edge mounted at 6'-8" A.F.F. Entire unit constructed of 18 GA type 304 stainless steel with #4 finish on all exposed surfaces.

2. 2" wide full perimeter integral gutter with 1/2" turn-up and 3/4" stainless steel drain connection.

3. Integral stainless steel rod hanger brackets, each corner.

4. Stainless steel duct tap collar with removable aluminum mesh filter.

5. Stainless steel perimeter closure panels to finished ceiling by K.E.C.; verify ceiling height.

ITEM #T11: HAND SINK

QUANTITY: One (1)
MANUFACTURER: Eagle Foodservice Equipment Company
MODEL NO.: HSA-10-FAW-LRS (N058)
PERTINENT DATA: Wall Mounted Assembly, With Wrist-Action Handles
UTILITIES REQ'D: 1/2" HW, 1/2" CW, 1-1/2" W
ALTERNATE MFRS.: Advance/Tabco; Select Stainless

Furnish and set-in-place per Equipment Plan, Sheet K3.1; Manufacturer's Instructions and the following:

1. Complete sink assembly consisting of: gooseneck faucet, p-trap, tailpiece and basket drain.

2. Accessories:
    -- #606215 skirt assembly.
    -- Left and right end splashes.

ITEM #T12: SOAP & TOWEL DISPENSER

QUANTITY:	One (1)
MANUFACTURER:	Bobrick Washroom Equipment, Inc.
MODEL NO.:	B-5050/B-262 (N058)
PERTINENT DATA:	Surface Wall Mounted, Stainless Steel Finish (400) C-Fold Capacity
UTILITIES REQ'D:	----
ALTERNATE MFRS.:	None

Furnish and set-in-place per Equipment Plan, Sheet K3.1; Manufacturer's Instructions and the following:

1. Mount units above hand sink and seal perimeter to wall.

ITEM #T13: THREE-COMPARTMENT SINK

QUANTITY:	One (1)
MANUFACTURER:	Custom Fabricated
MODEL NO.:	#14 GA Stainless Steel
PERTINENT DATA:	8'-9" Long x 2'-6" Wide x 2'-10" High
UTILITIES REQ'D:	(2) 1/2" HW, (2) 1/2" CW, (3) 2" IW
ALTERNATE MFR.:	None

Fabricate and set-in-place per Equipment Plan, Sheet K3.1; Fabrication Detail, Sheet K3.5; and the following:

1. Front and end edge rolls per Detail 1.02B.

2. 13" high backsplash per Detail 1.04A.

3. Framework per Detail 1.05.

4. Legs per Detail 1.07.

5. Stainless steel undershelf on both ends per Detail 1.11.

6. Pot sink and drainboards per Detail 3.01.

7. Sound-deaden underside of sinks and drainboards with NSF-approved sound dampening material.

8. Accessories:
   -- Two (2) T&S #B-0231 backsplash-mounted swing spout faucets with #B-0199-01F-10 aerator.
   -- Three (3) T&S #B-3950-01 twist waste valves with overflow assemblies and #010387-45 basket strainers .

9. Item will remain shrink-wrapped until ready for final connection by Plumbing Contractor. Immediately following completion of final connections, K.E.C. shall re-shrink-wrap tubs or provide removable panel to avoid use by construction trades. Post sign on wall above sink tubs in English and Spanish stating: WARNING! NOT TO BE USED BY CONSTRUCTION TRADES. FAILURE TO COMPLY WILL RESULT IN $500.00 FINE AND ALL COSTS TO REPLACE ITEM WITH NEW.

ITEM #T14: SOILED DISHTABLE

QUANTITY: One (1)
MANUFACTURER: Custom Fabricated
MODEL NO.: #14 GA Stainless Steel
PERTINENT DATA: 5'-0" Long x 2'-6" Wide x 2'-10" High
UTILITIES REQ'D: 1/2" HW, 1/2" CW, 1-1/2" IW
ALTERNATE MFRS.: None

Fabricate and set-in-place per Equipment Plan, Sheet K3.1; Fabrication Detail Sheet K3.5; and the following:

1. Front and left end edge roll per Detail 1.02B.

2. 13" high backsplash per Detail 1.04A.

3. Framework per Detail 1.05.

4. Legs per Detail 1.07.

5. Crossbracing per Detail 1.10.

6. Soiled dishtable per Detail 2.02.

7. 20" wide x 8" deep integral pre-rinse sink with one-piece removable #20 gauge perforated stainless steel scrap basket with 1" diameter fully welded tubular cross-rails set flush with tabletop. Raise deck at rear of sink 6" for deck-mounted pre-rinse spray and extend to opening of dishmachine to act as rack guide.

8. 3'-6" long table-mounted single-sided slanted glass rack shelf per Detail 2.19.

9. Sound-deaden underside of sink and drainboard with NSF-approved sound dampening material.

10. Accessories:
    -- One (1) T&S #B-0113-BJ deck-mounted pre-rinse spray with built-in back flow preventer and #B-109 wall bracket.
    -- One (1) Component Hardware #D63-4161 box pattern drain assembly welded to underside of pre-rinse sink.

ITEM #T15: WALL CABINET

QUANTITY: Three (3)
MANUFACTURER: Eagle Foodservice Equipment Co., Inc.
MODEL NO.: WCH-48 (N058)
PERTINENT DATA: Wall Mounted, 4'-0" Wide, Hinged Doors, #18GA Stainless Steel
UTILITIES REQ'D: ----
ALTERNATE MFRS.: Select Stainless

Furnish and set-in-place per Equipment Plan, Sheet K3.1; Manufacturer's Instructions and the following:

1. Mount cabinet with bottom @ 56" A.F.F.; Seal perimeter to wall with clear silicone sealant.

2. Accessories:
    -- Cylinder door lock.

ITEM #T16: DISHMACHINE

QUANTITY:	One (1)
MANUFACTURER:	Meiko
MODEL NO:	DV 120.2T (N058)
PERTINENT DATA:	Fully-Automatic, High-Temp, Door-Type, With Built-in Booster Heater (70°F Rise), Tall Chamber
UTILITIES REQ'D:	27.1A, 480V, 3PH; 10.0A, 120V, 1PH; 3/4"HW (140°F.), 1/2"CW (Drain Water Cooling Kit), 2" IW
ALTERNATE MFRS.:	Hobart Corporation; Jackson

Furnish and set-in-place per Equipment Plan, Sheet K3.1; Manufacturer's Instructions and the following:

1. Factory installed vacuum breaker.

2. Soap dispensing system and rinse additive system by chemical vendor.

3. Stainless steel feet, frame, legs and front panel.

4. Electric tank heat.

5. Corner installation.

6. Vent fan control.

7. Accessories:
   -- Two (2) #MPR peg-type dish racks.
   -- Two (2) #MCR combination-type dish racks.
   -- One (1) drain water tempering kit.
   -- One (1) built-in booster heater.
   -- One (1) splash panel kit for corner installation.
   -- One (1) built-in liquid detergent and rinse aid pumps.

ITEM #T17: CLEAN DISHTABLE

QUANTITY:	One (1)
MANUFACTURER:	Custom Fabricated
MODEL NO.:	#14 Gauge Stainless Steel Construction
PERTINENT DATA:	4'-0" L x 2'-6" W x 2'-10" H
UTILITIES REQ'D:	----
ALTERNATE MFRS.:	None

Fabricate and set-in-place per Equipment Plan, Sheet K3.1; Fabrication Detail, Sheet K3.5; and the following:

1. Front and right end edge roll per Detail 1.02B.

2. 13" high backsplash per Detail 1.04A.

3. Framework per Detail 1.05.

4. Legs per Detail 1.07.

5. Undershelf per Detail 1.11.

ITEM #T17: (Continued)

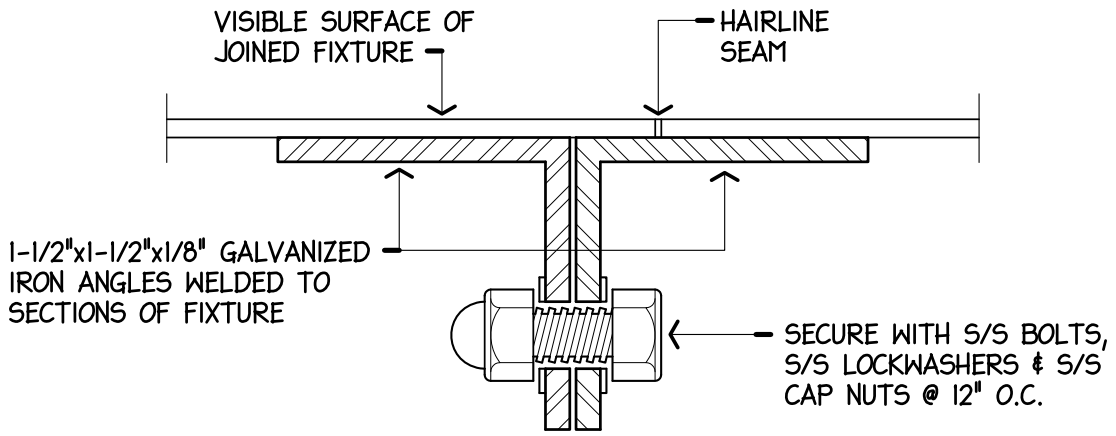
6. Dishtable per Detail 2.02.

7. Sound deaden underside of drainboard with NSF-approved sound dampening material.

8. Install table limit switch (supplied with Dishmachine, Item #T16) in end of dishtable, inter-wired by Electrical Contractor.

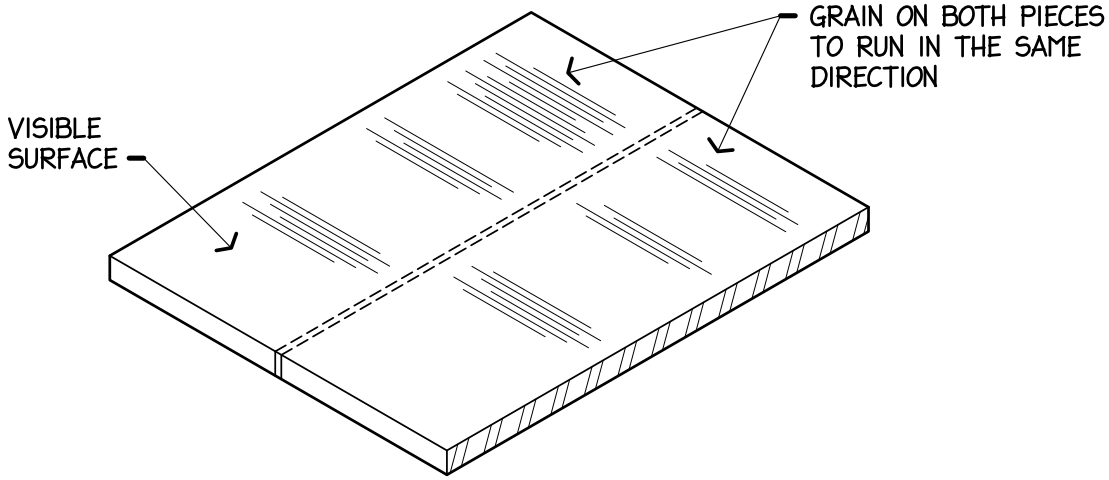
(END OF FOODSERVICE ITEMIZED SPECIFICATIONS)

STANDARD DETAILS



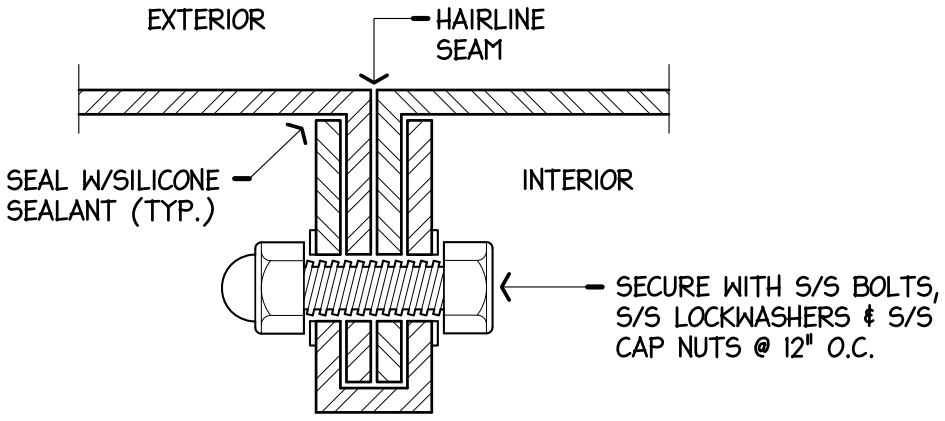
NOTE! JOINED SECTIONS SHALL BE DRAWN TOGETHER LEAVING ONLY A HAIRLINE SEAM.

A. BOLT DRAWN JOINT



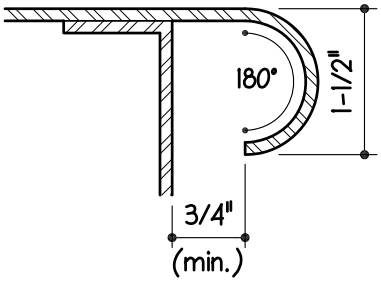
NOTE! ON FIXTURES SPECIFIED WITH WELDED FIELD JOINTS, WELDS SHALL BE CONTINUOUS, GROUND & POLISHED LEAVING NO VISIBLE EVIDENCE OF WELD.

B. WELDED BUTT JOINT

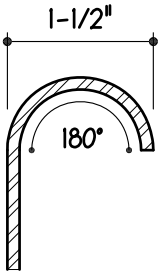


NOTE! JOINED SECTIONS SHALL BE DRAWN TOGETHER LEAVING ONLY A HAIRLINE SEAM.

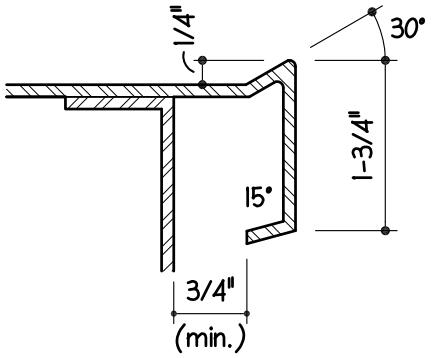
C. RAISED CAP SEAM - KNUCKLE JOINT



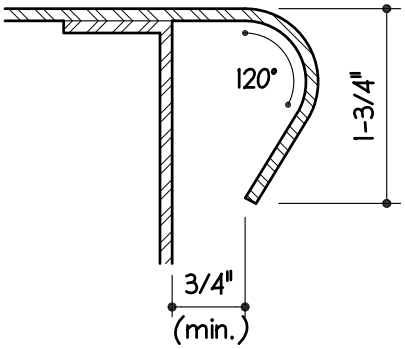
ROLLED A.



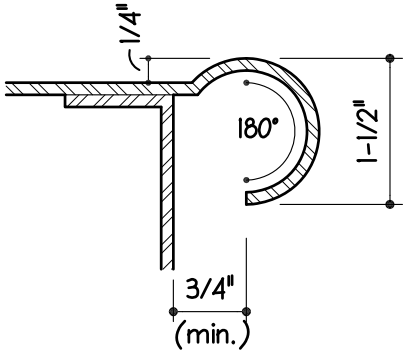
RAISED ROLLED B.



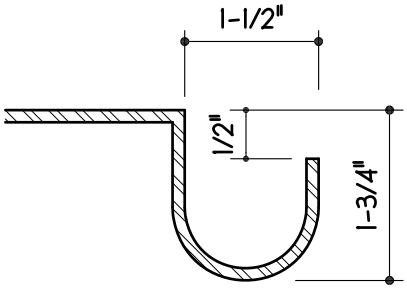
INVERTED "V" EDGE C.



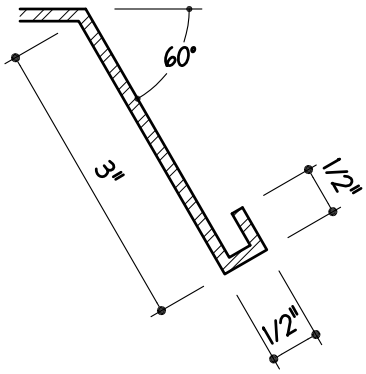
BULL NOSE ROLLED D.



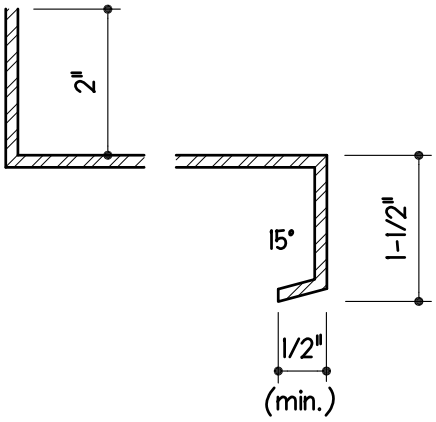
MARINE EDGE E.



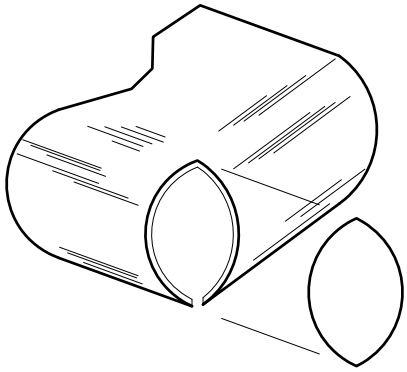
FLOUR GUTTER F.



RECIPE CARD HOLDER G.

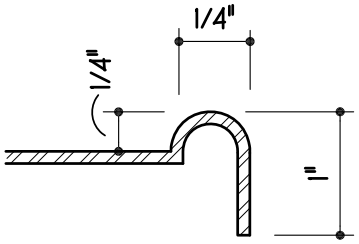


UNDERSHELF EDGE H.

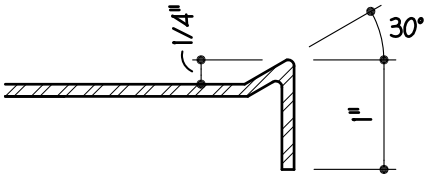


BULL NOSE CORNER I.

NYIKOS ASSOCIATES, INC. *Food Facilities Design/Consulting*	DESCRIPTION: **EDGES**	STANDARD DTL: **1.02** PAGE: **114000-68**

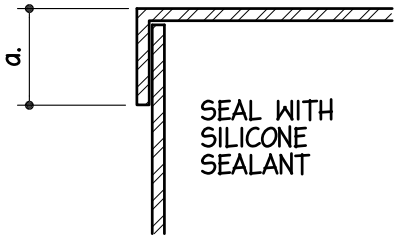


RAISED OPENING EDGE J.

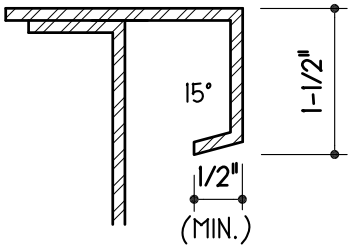


RAISED OPENING EDGE K.

a. AS SPECIFIED. TO MATCH ADJACENT ROLLED EDGES



STRAIGHT TURN DOWN L.



TURNED DOWN EDGE M.

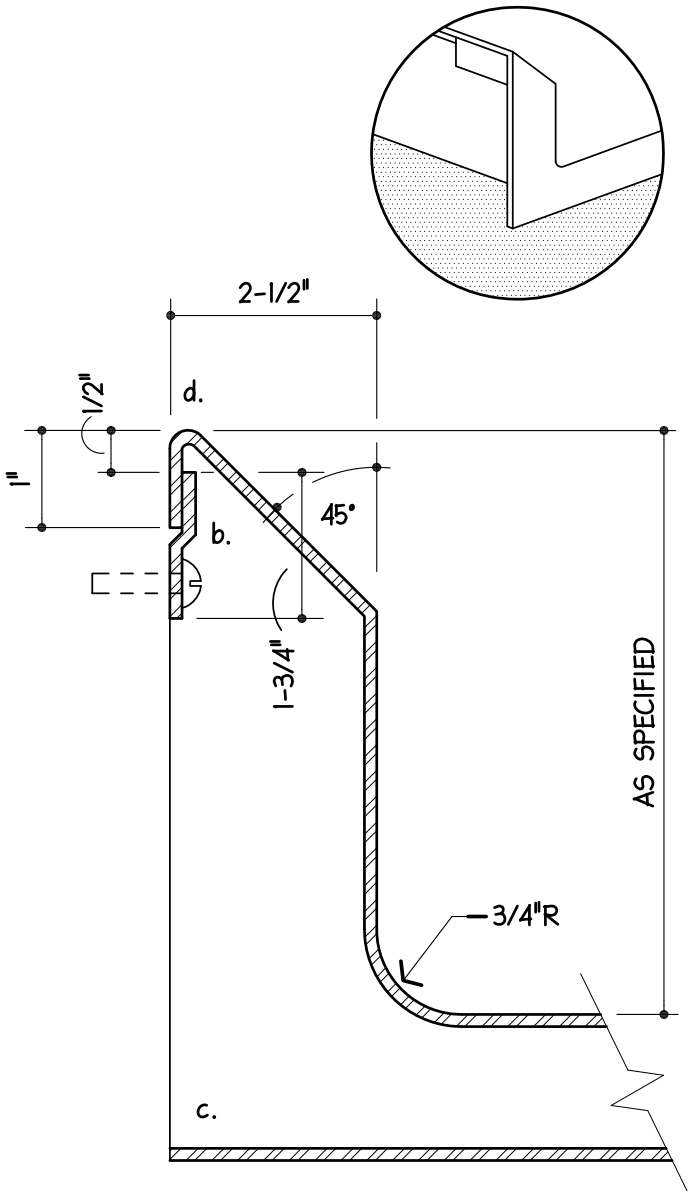
NYIKOS ASSOCIATES, INC.
Food Facilities Design/Consulting

DESCRIPTION:

EDGES

STANDARD DTL: 1.02.1

PAGE: 114000-69



WALL UNIT

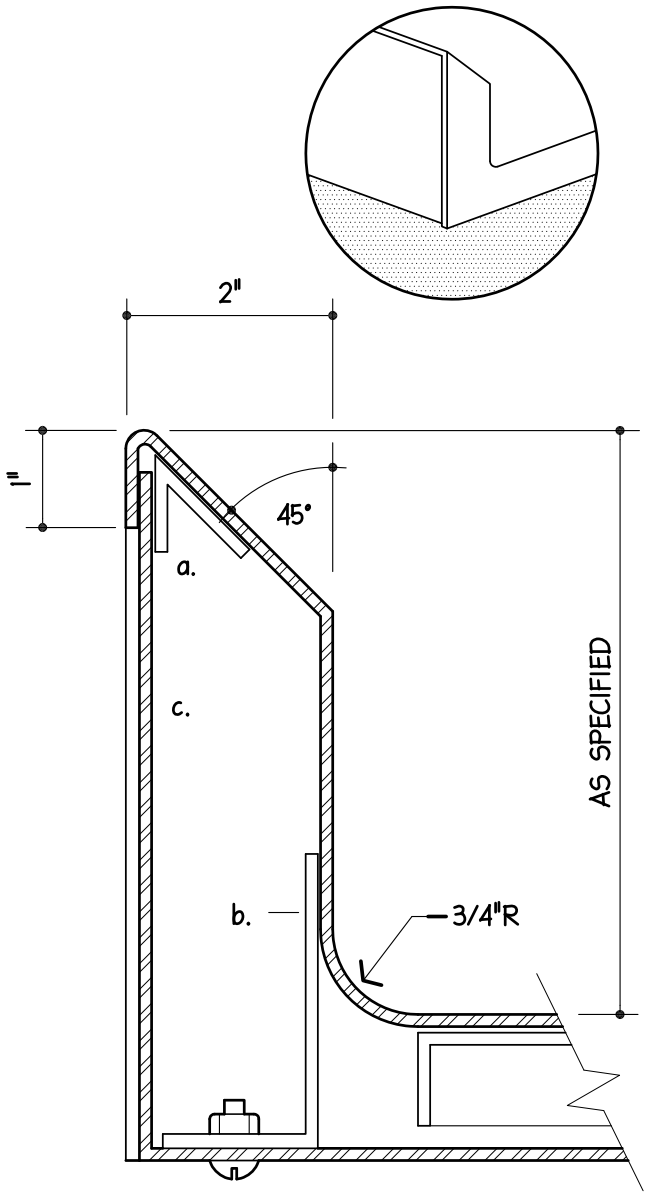
DETAIL A

a. 2-1/2" AT SINK TO ALLOW FOR CONNECTED OVERFLOW

b. 12 GA. S/S CLIPS, 4" LONG, FASTENED TO EACH WALL END OF EACH UNIT ℄ 4'-0" ON CENTER. SECURE TO WALL W/A MINIMUM OF TWO 1/4"x20 S/S TOGGLE BOLTS OR EXPANSION SHIELDS.

c. EXPOSED ENDS TO BE FULLY WELDED CLOSED.

d. SEAL ALL AROUND TO WALL WITH SILICONE SEALANT.



FREE STANDING UNIT

DETAIL B

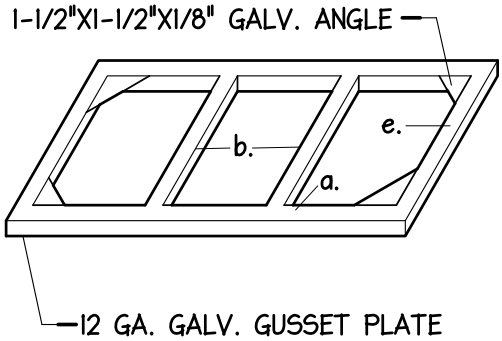
a. 1"x1"x14 GA. S/S x1-1/2"LONG RETAINING CLIP WELDED IN PLACE. ONE AT EACH END OF UNIT AND 12" ON CENTER.

b. 2-1/2"x1-1/2x1-1/2" 14 GA.S/S CLIP WELDED TO SPLASH. ONE AT OF EACH UNIT ℄ 12" ON CENTER.

c. 14 GA S/S PANEL SECURED TO CLIPS W/ S/S OVALHEAD BOLT. WELD NUT TO CLIP.

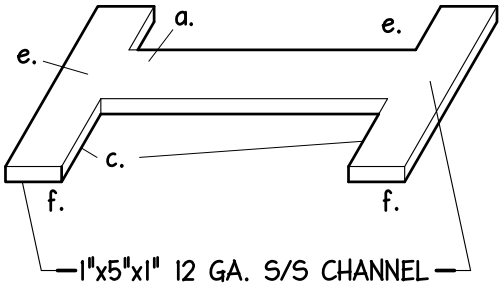
d. EXPOSED ENDS TO BE FULLY WELDED.

NYIKOS ASSOCIATES, INC. *Food Facilities Design/Consulting*	DESCRIPTION: **BACKSPLASHES**	STANDARD DTL: **1.04** PAGE: **114000-70**



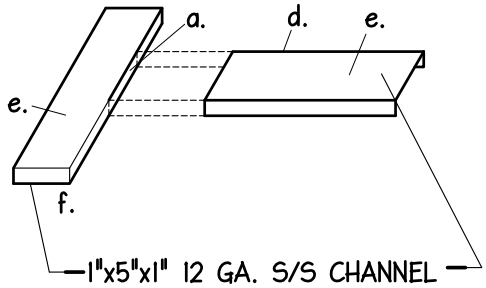
TABLES

A.



DISHTABLES

B.



SINK DRAINBOARDS

C.

---

a. FULLY WELDED CONSTRUCTION.

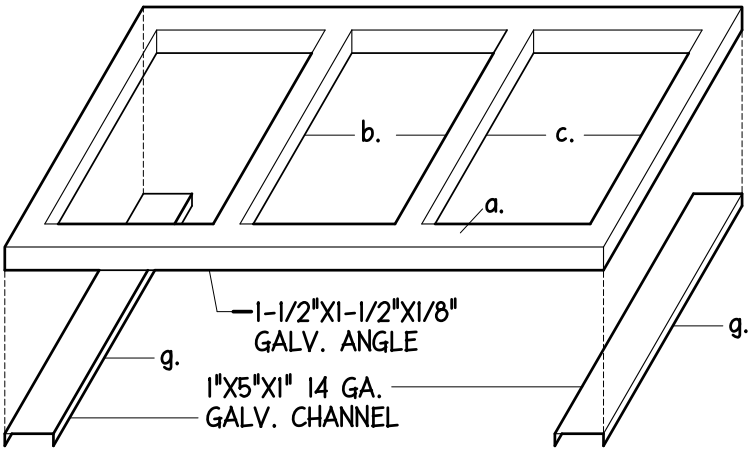
b. ANGLE LOCATION - ENDS; SIDES OF TOP INSETS; INTERMEDIATES 24" ON CENTER.

c. CHANNEL LOCATION - ENDS AND INTERMEDIATE MAXIMUM 6'-6" O.C.

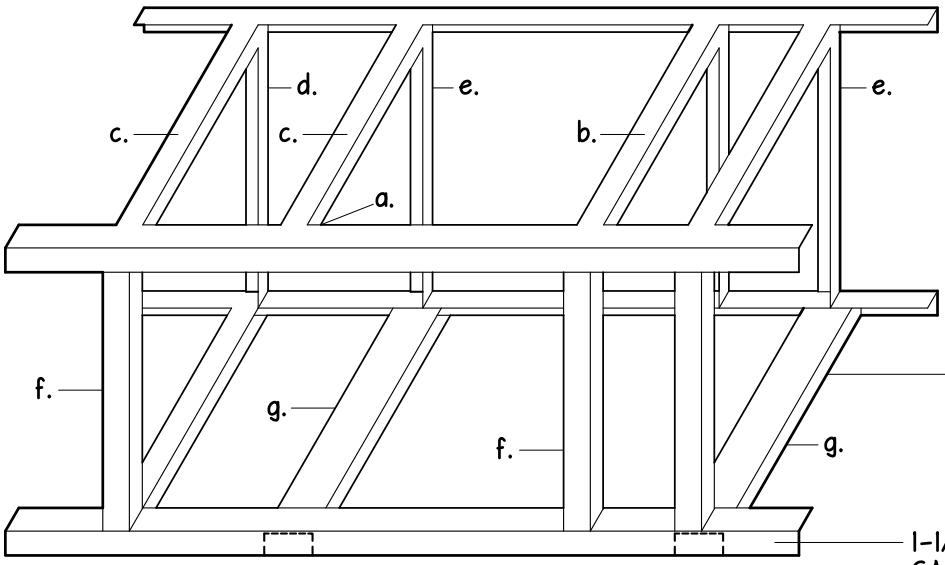
d. ADD CENTER CHANNEL WHEN DRAINBOARD LENGHT EXCEEDS 5'-6".

e. SECURE TOP TO FRAMEWORK WITH WELDED STUDS, S/S LOCKWASHERS AND CAP NUTS.

f. CLOSE CHANNEL AT FRONT ONLY.



FRAME FOR STRUCTURALLY FORMED CABINET BODY



BOX FRAME FOR PANEL CABINET BODY

a. FULLY WELDED CONSTRUCTION.

b. SECURE TOP TO FRAMEWORK WITH WELDED STUDS, S/S LOCKWASHERS, AND CAP UNITS. MAXIMUM 15" ON CENTER.

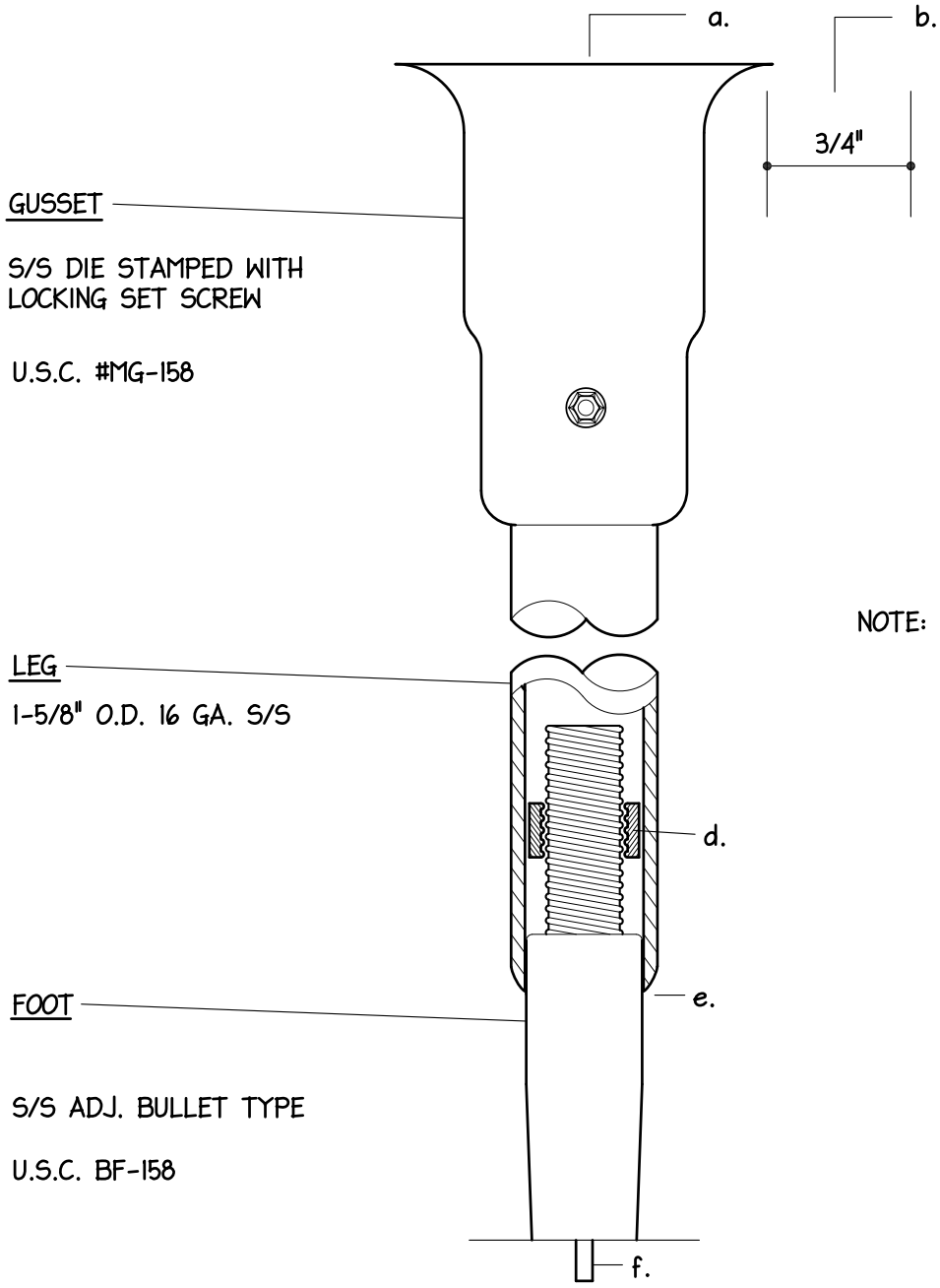
c. TOP ANGLE LOCATION - ENDS; SIDES OF TOP INSETS; UNDER HEAVY EQUIPMENT LEGS; INTERMEDIATES 24" ON CENTER.

d. BACK ANGLE LOCATION - ENDS; INTERMEDIATE MAXIMUM 5'-6" ON CENTER.

e. CAFETERIA FRONT ANGLE (CHANNEL) LOCATION - ENDS; INTERMEDIATES TO CORRESPOND TO PILASTERS, SLIDE BRACKETS, PANEL SPACING, MAXIMUM 4'-0" ON CENTER.
RE: STDS.-4.01 THRU 4.04.

f. WORK SIDE ANGLE LOCATION - ENDS; SIDE OF OPENINGS; INTERMEDIATES MAXIMUM 5'-6" ON CENTER.

g. BOTTOM LEG CHANNEL LOCATION - ENDS; INTERMEDIATES CORRESPOND TO FRONT PANEL SPACING; PILASTERS, SLIDE BRACKETS. MAXIMUM 5'-6" ON CENTER.



NOTE: ENTIRE FINISHED STRUCTURE AND INDIVIDUAL COMPONENTS TO MEET NSF REQUIREMENTS

a. FULLY WELD GUSSET TO FRAMEWORK OR SINK

b. 3/4" MINIMUM CLEARANCE ALL AROUND

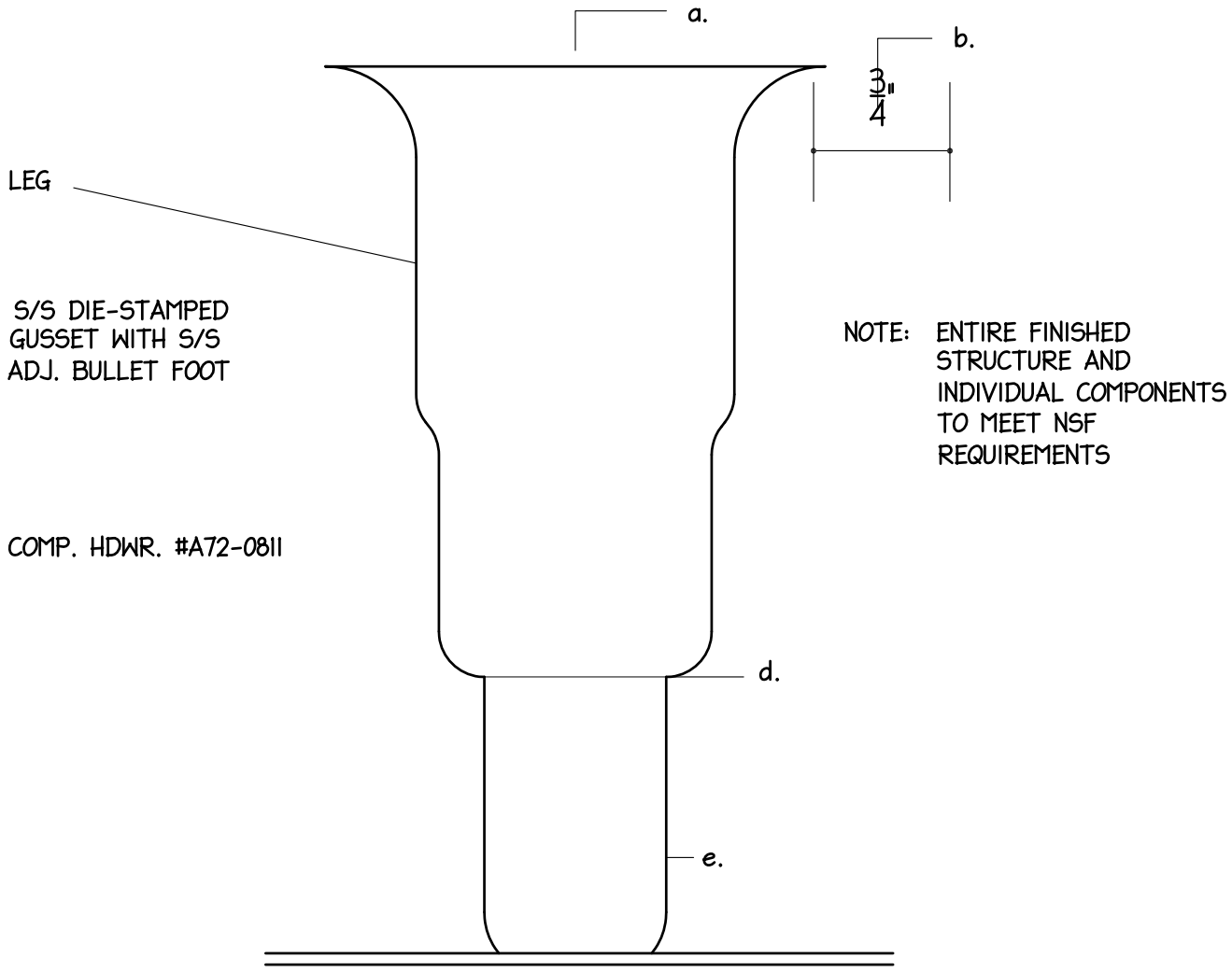
c. SET SCREW NOT VISIBLE TO WORKING SIDE OF EQUIPMENT.

d. MAXIMUM 1/32" CLEARANCE BETWEEN LEG AND FOOT

e. FOOT SET AT MIDPOINT TO ALLOW 1" ADJUSTMENT UP AND 1" DOWN. WITHOUT THREAD EXPOSURE.

f. LEGS UNSUPPORTED LATERALLY BY CROSSBACKING OR UNDERSHELVES SHALL BE PINNED TO FLOOR USING 1/4" DIA. X 1/2" PINS WELDED TO FOOT AND SET IN MATCHING HOLES IN THE FLOOR.

NYIKOS ASSOCIATES, INC. Food Facilities Design/Consulting	DESCRIPTION: TABLE & SINK LEGS	STANDARD DTL: 1.07
		PAGE: 114000-73



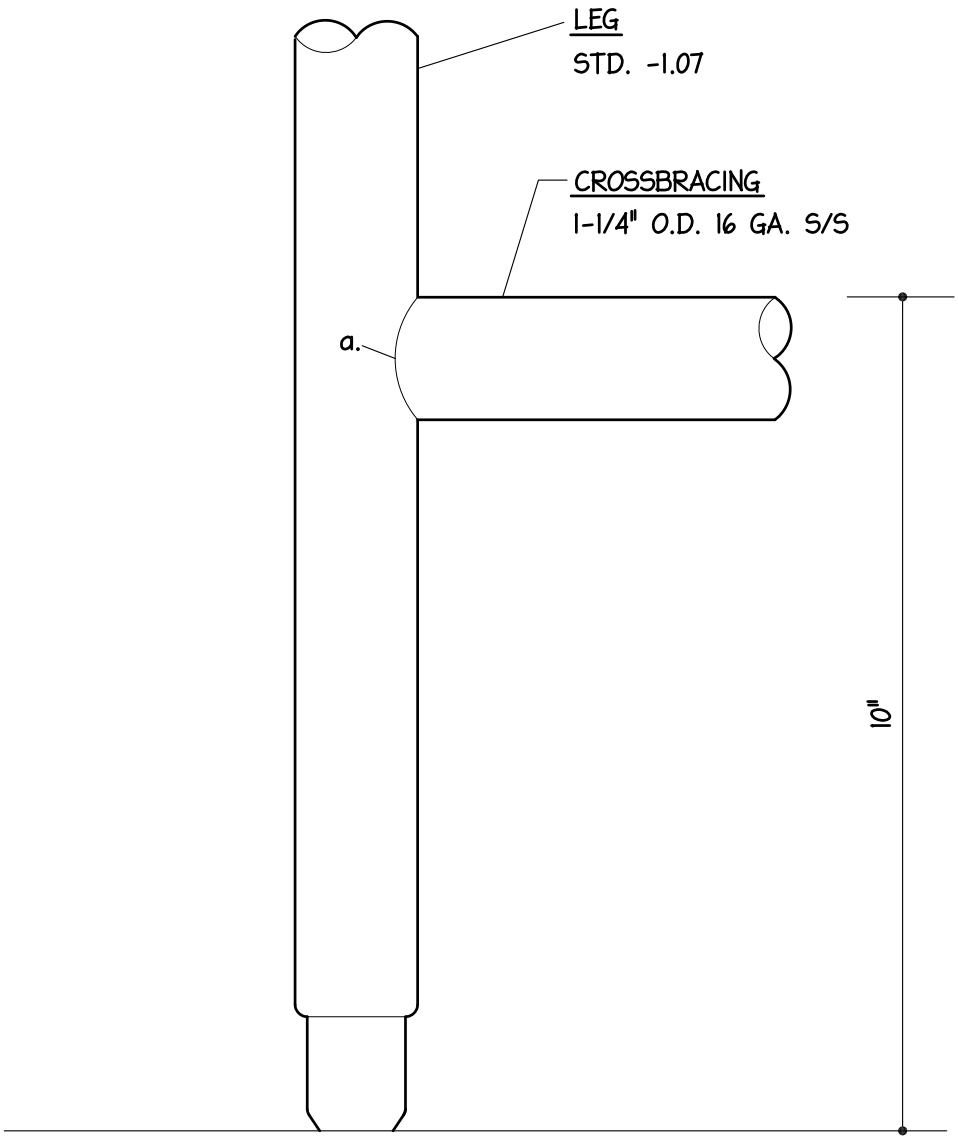
a. FULLY WELD TO FRAMEWORK CHANNEL

b. 3/4" MINIMUM CLEARANCE ALL AROUND

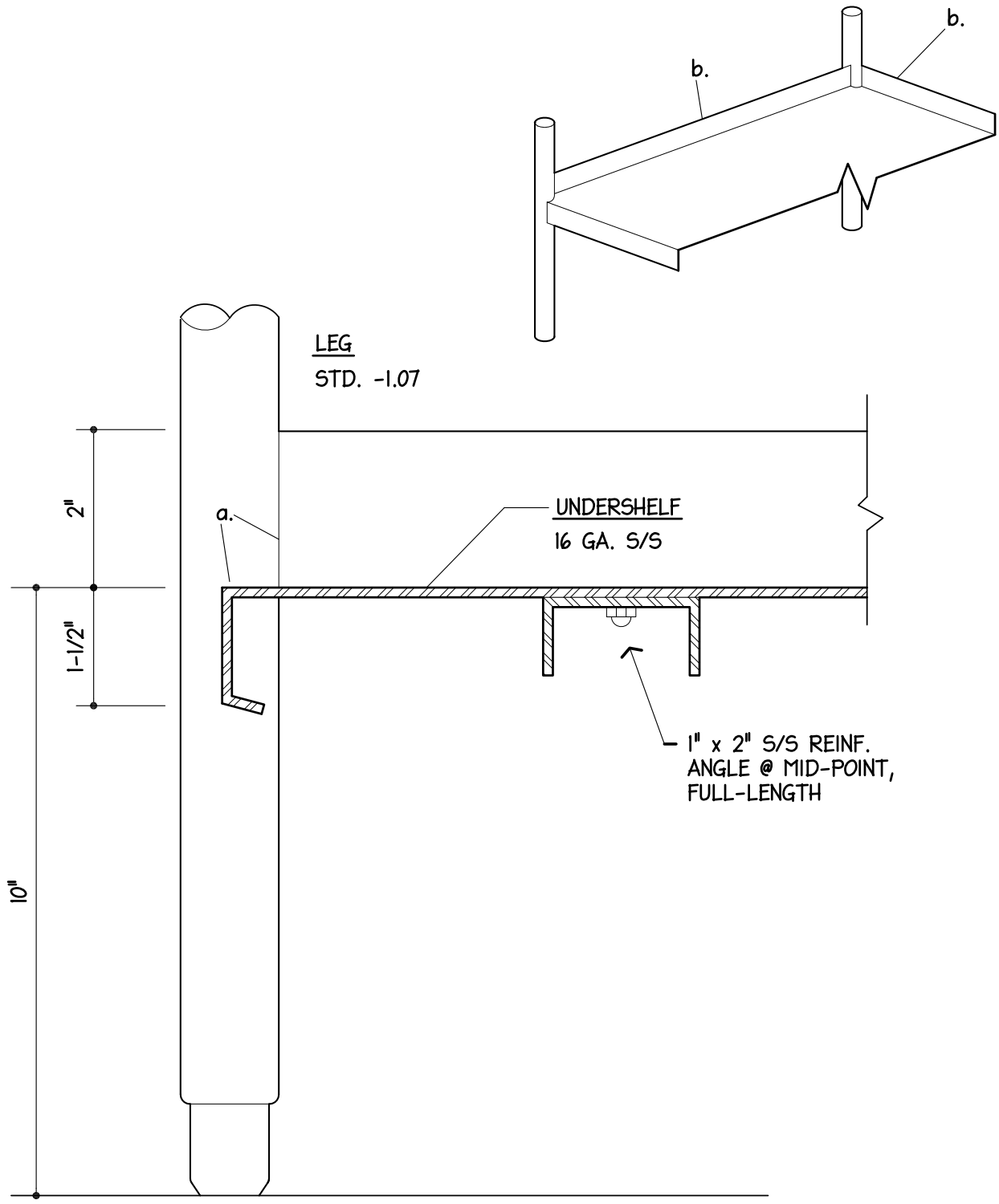
d. MAXIMUM 1/32" CLEARANCE BETWEEN LEG AND FOOT

e. FOOT SET AT MIDPOINT TO ALLOW 1" ADJUSTMENT UP AND 1" DOWN. WITHOUT THREAD EXPOSURE.

NYIKOS ASSOCIATES, INC. Food Facilities Design/Consulting	DESCRIPTION: COUNTER LEGS	STANDARD DTL: 1.08
		PAGE: 114000-74



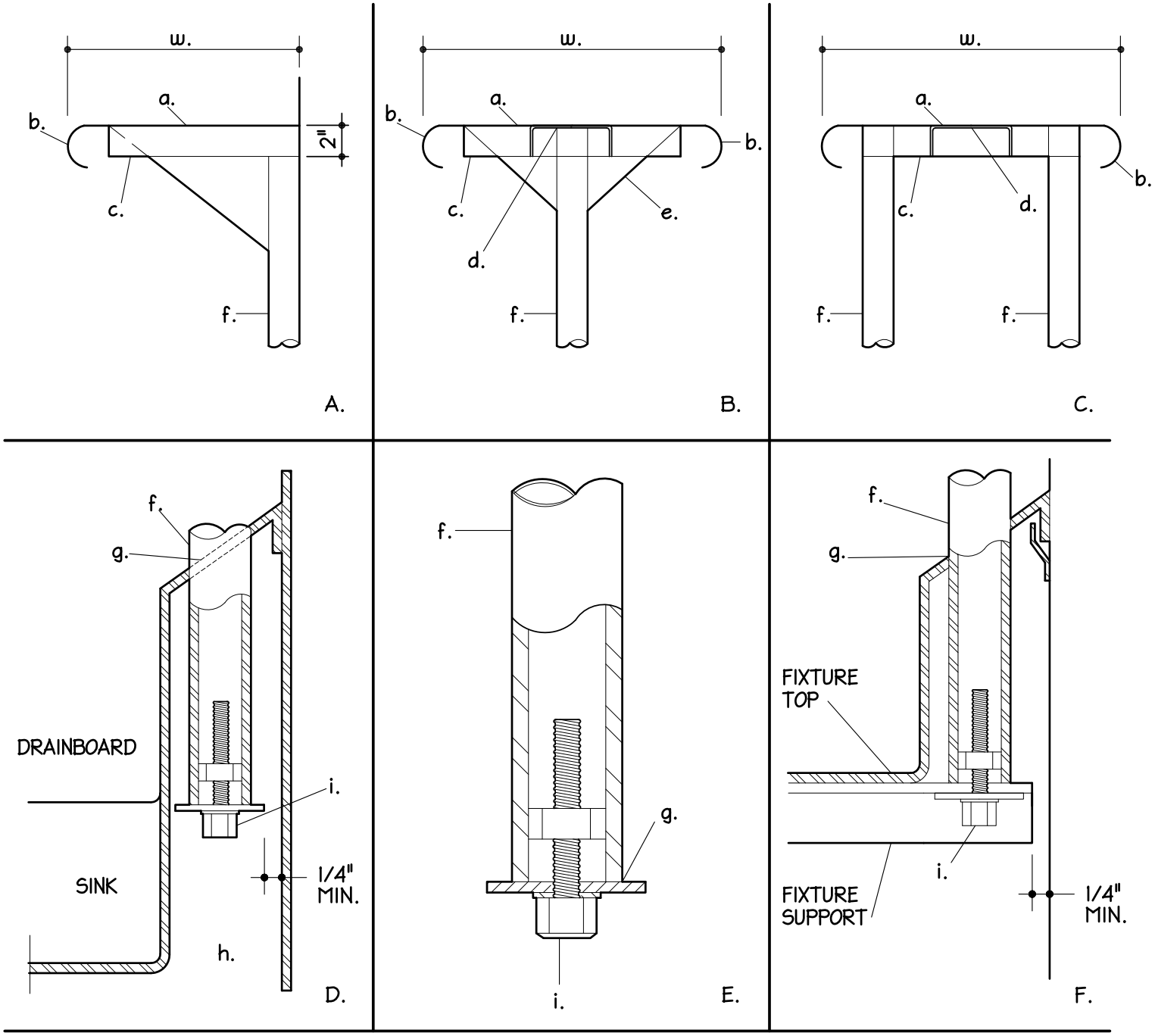
a. FULLY WELD, GRIND SMOOTH AND POLISH.



a. FULLY WELD, GRIND SMOOTH AND POLISH.

b. WHEN SPECIFIED, TURN REAR AND ENDS UP 2".

NYIKOS ASSOCIATES, INC. Food Facilities Design/Consulting	DESCRIPTION: UNDERSHELF	STANDARD DTL: 1.11
		PAGE: 114000-76



a. 16 GA S/S SHELF

b. STD.- 1.02 EDGE

c. 1"x 3"x 1" 14 GA. S/S CROSS CHANEL

d. 1'x 3"x 1" 14 GA. S/S LENGTHWISE CHANNEL WHEN LENGTH BETWEEN SUPPORTS EXCEEDS 42"

e. 14 GA. S/S BRACKETS FULLY WELDED TO SUPPORT AND CHANNEL..

f. 1-1/4" O.D. 16 GA. S/S UPRIGHT. MAXIMUM 5'-0" ON CENTER.

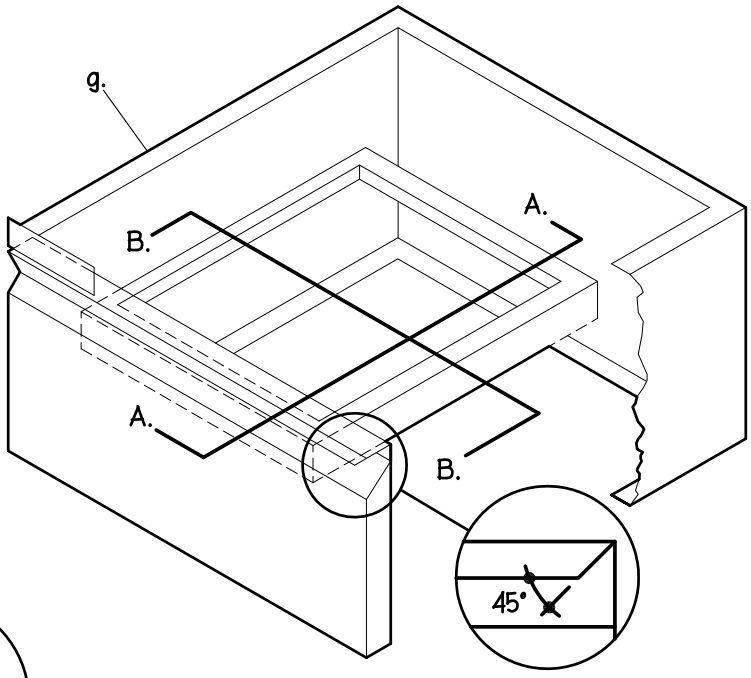
g. TIGHT FIT. SEAL WITH SILICONE SEALANT.

h. 1-1/2"x 1-1/2" 12 GA. S/S CLIPS WELDED TO REAR OF SPLASH AT DRAINBOARD HEIGHT.

i. 3/8"x 16 S.S. HEX HEAD BOLT, S/S NUT ¢ S/S LOCKWASHER. NUT WELDED IN TUBE.

w. WIDTH AS SPECIFIED.

NYIKOS ASSOCIATES, INC. *Food Facilities Design/Consulting*	DESCRIPTION: **OVERSHELVES & SUPPORTS**	STANDARD DTL: **1.12** PAGE: **114000-77**



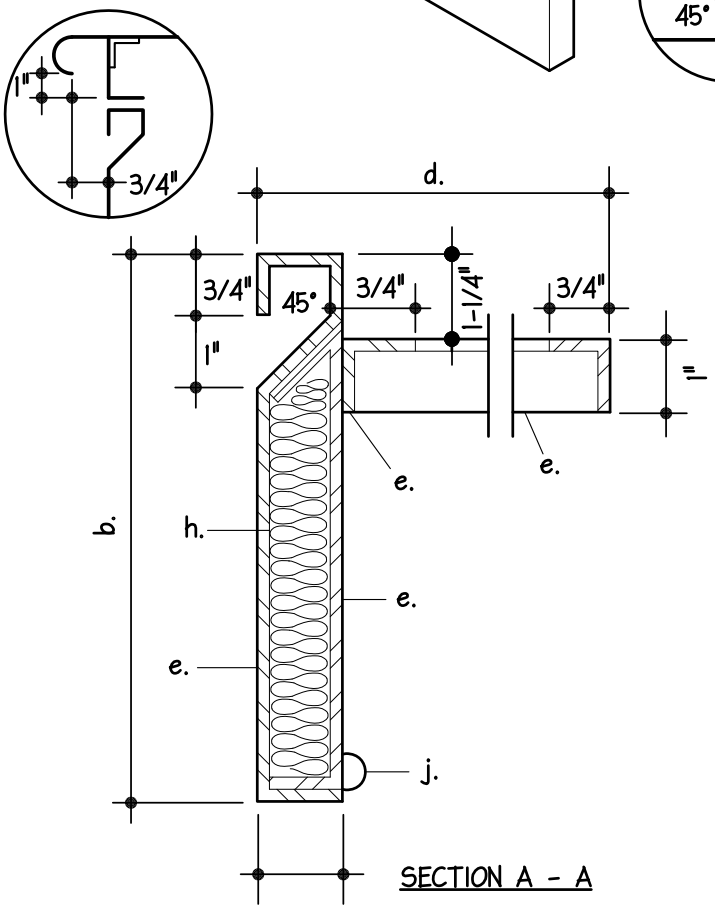
e. 16 GA. S/S ALL WELDED.

f. 3 PIECE SELF CLOSING DWR. SLIDE AS MFD. BY COMPONENT HARDWARE, S52 SERIES WITH S/S ROLLER BEARINGS. PITCH SLIDE DOWNWARD 3/8" PER FOOT FOR SELF-CLOSING ACTION.

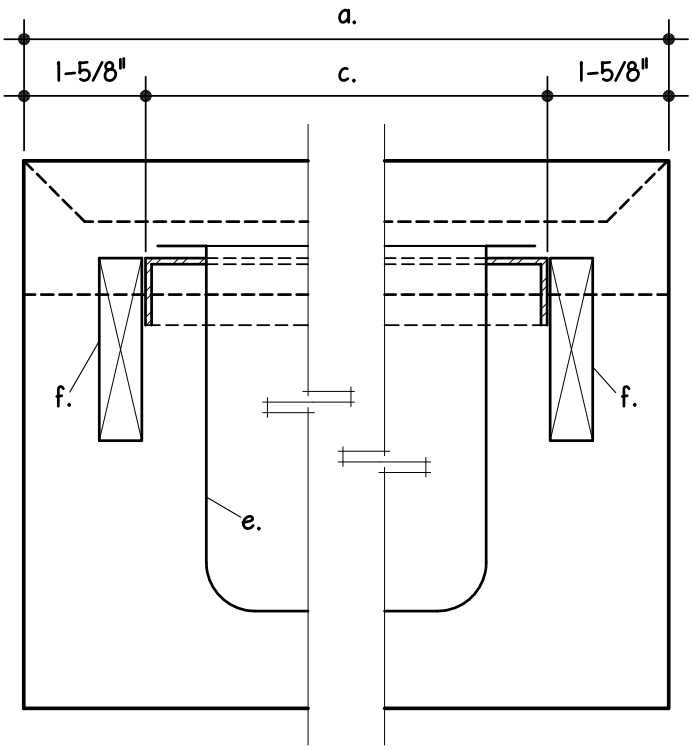
g. 18 GA. S/S DWR. ENCLOSURE. ALL WELDED.

h. SEMI - RIGID FIBERGLASS SOUND DAMPENING.

j. HARD RUBBER DRAWER BUMPER EACH CORNER.



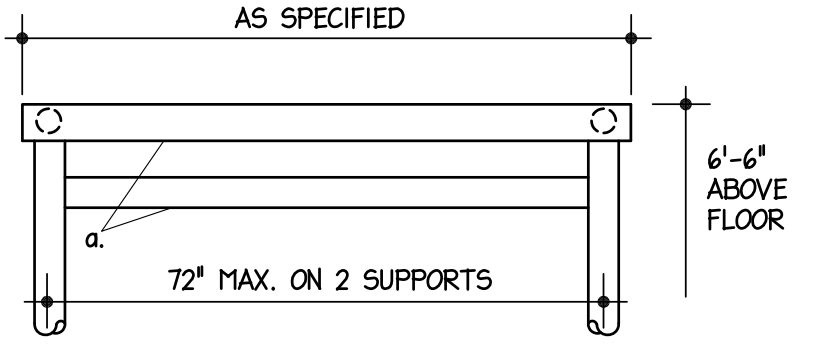
SECTION A - A



SECTION B -B

i. PROVIDE DIE - STAMPED #18 GA. S/S DWR. PANS AS FOLLOWS:

TYPE	NO.	PANS	a.	b.	c.	d.
I	1	20x20x5 DP.	25	7-1/2	21-3/4	22-3/4
II	1	20x20x8 DP.	25	10-1/2	21-3/4	22-3/4
III	1	12x20x4 DP.	25	6-1/2	21-3/4	14-1/2
IV	2	12x20x4 DP.	28	6-1/2	26-1/4	22-1/2
V	1	12x20x4 DP.	17	13-1/2	13-1/2	22-1/2



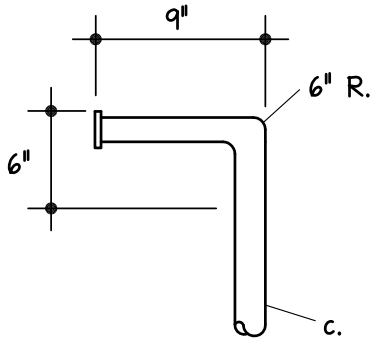
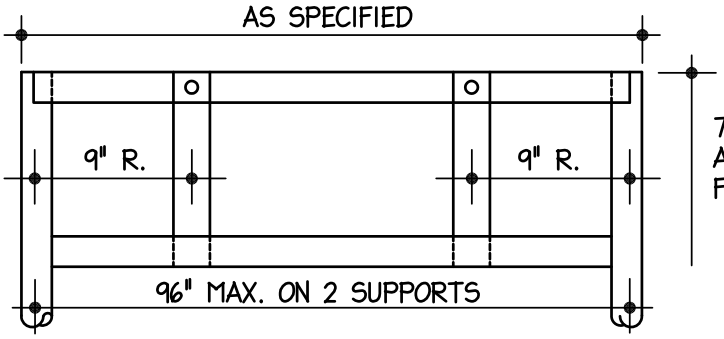


TABLE MTD. SINGLE SIDE a.



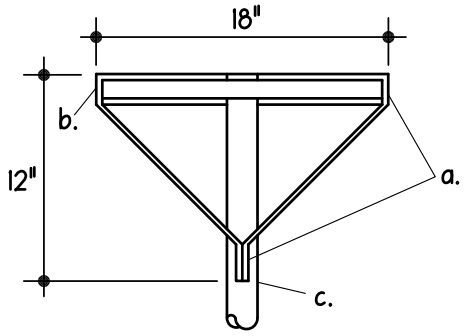
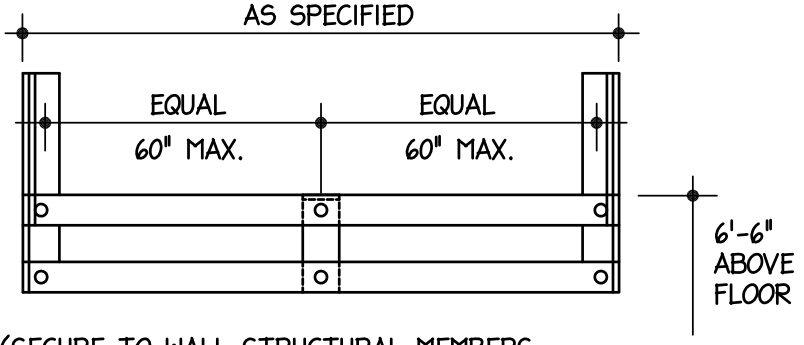
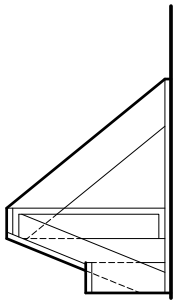


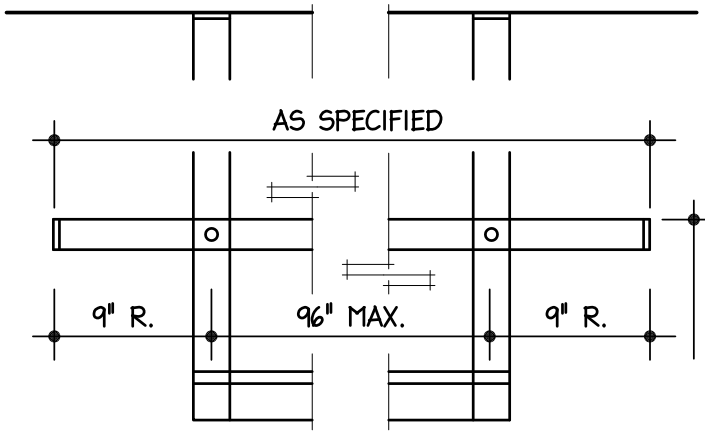
TABLE MTD. DOUBLE SIDE b.

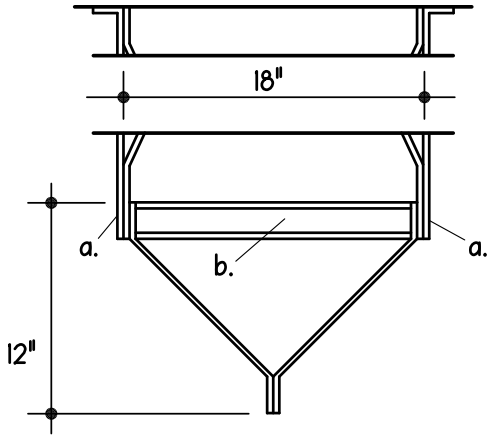


(SECURE TO WALL STRUCTURAL MEMBERS WITH S/S BOLTS)



WALL MOUNTED c.





CEILING MOUNTED d.

RACKS TO BE ALL WELDED CONSTRUCTION, GROUND SMOOTH AND POLISHED

a. BANDS - 1/4"x2 S/S BAR.
b. SPREADERS - 1" O.D. 16 GA. S/S.
c. UPRIGHTS - 1-5/8" O.D. 16 GA. S/S.
d. HOOKS - S/S DOUBLE PRONG SNAP-OVER STANDARD KEIL - #1576-1010-1351, 6" O/C.

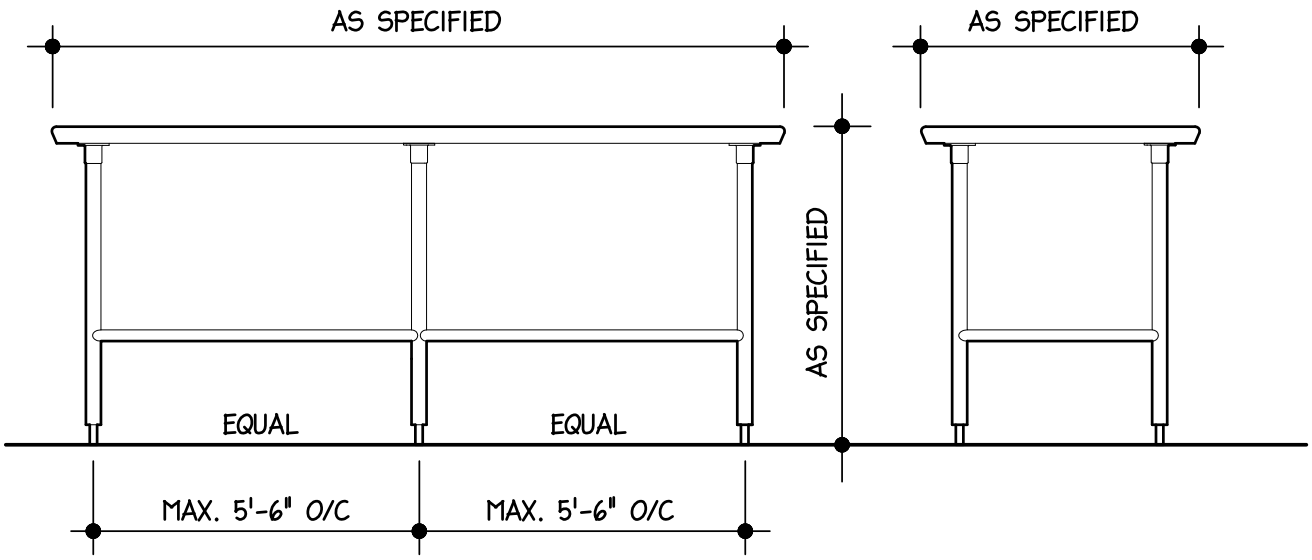
NYIKOS ASSOCIATES, INC.
Food Facilities Design/Consulting

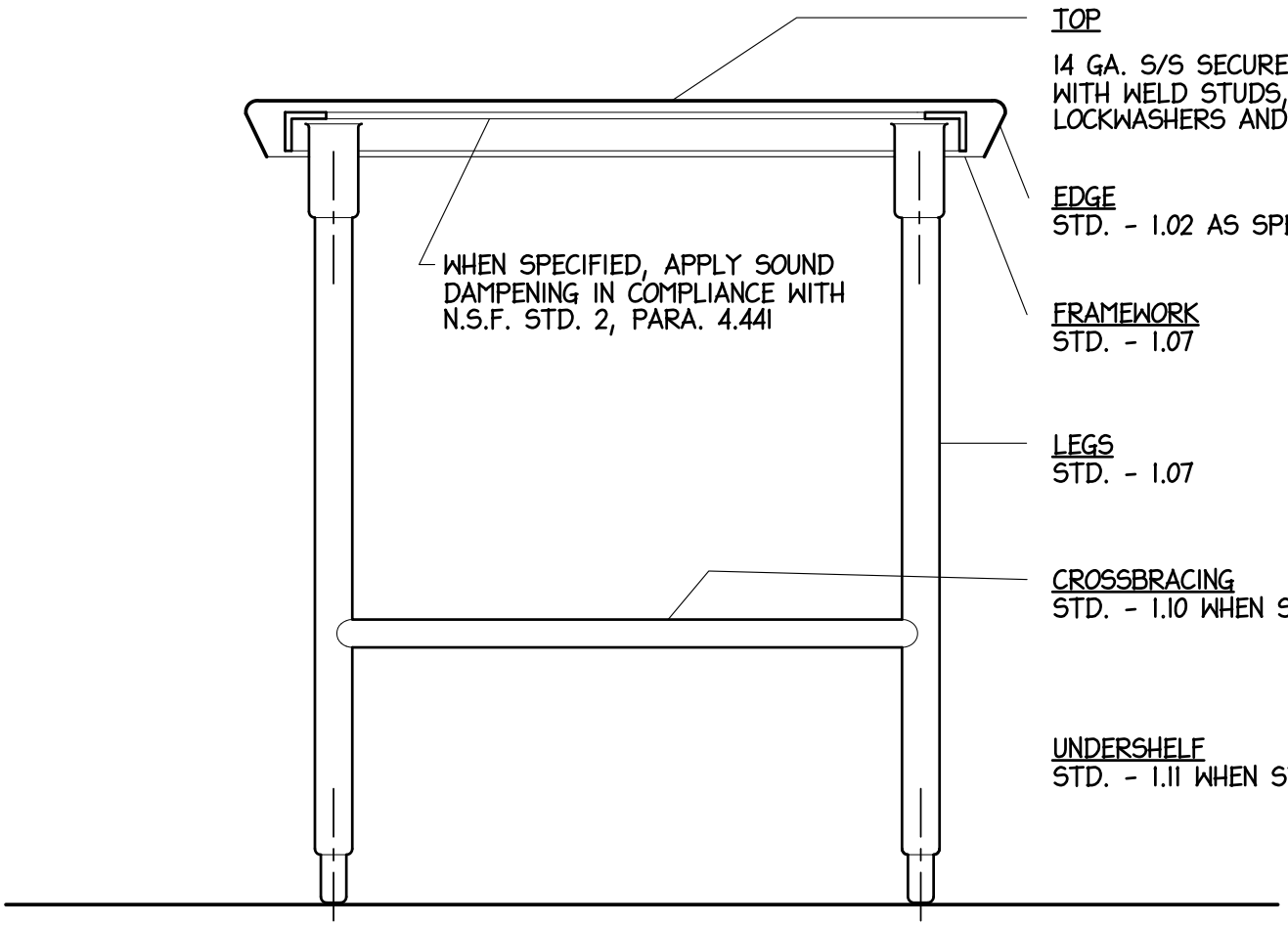
DESCRIPTION:

POT RACKS

STANDARD DTL: 1.18

PAGE: 114000-79





TOP

14 GA. S/S SECURED TO FRAME WITH WELD STUDS, S/S LOCKWASHERS AND CAP NUTS.

EDGE
STD. - 1.02 AS SPECIFIED.

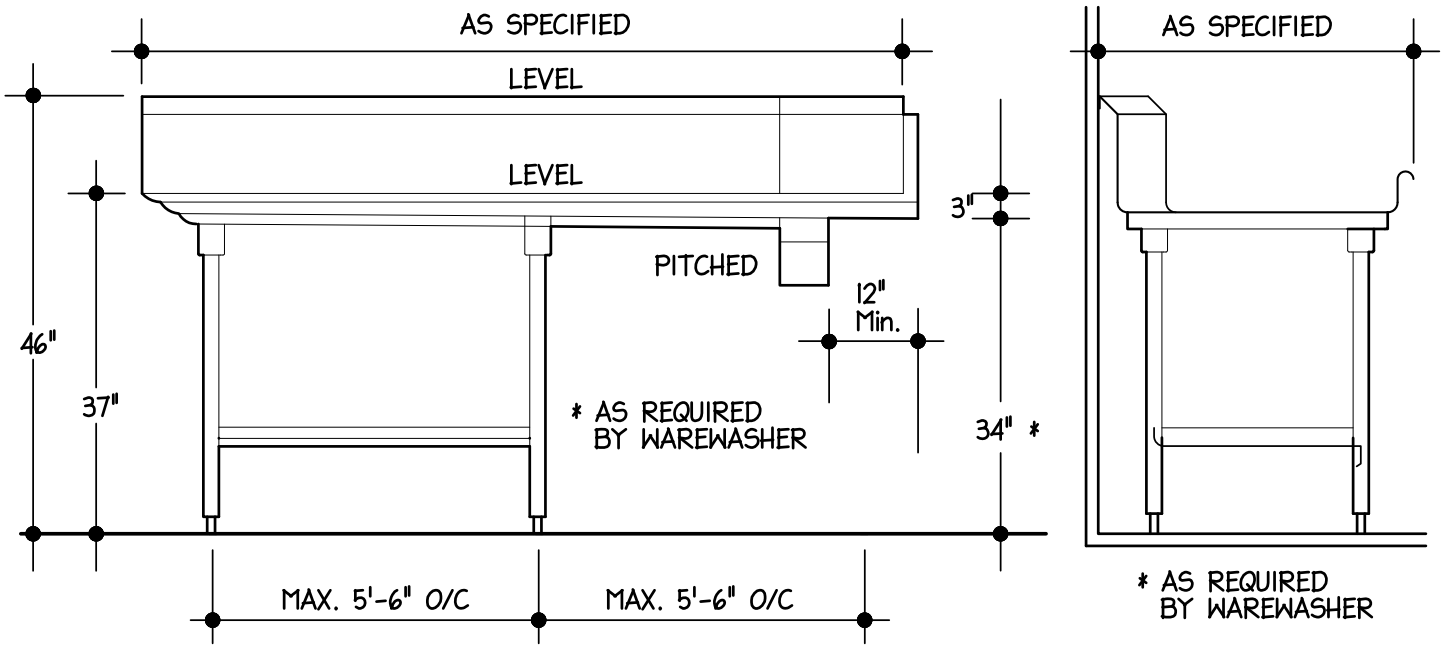
FRAMEWORK
STD. - 1.07

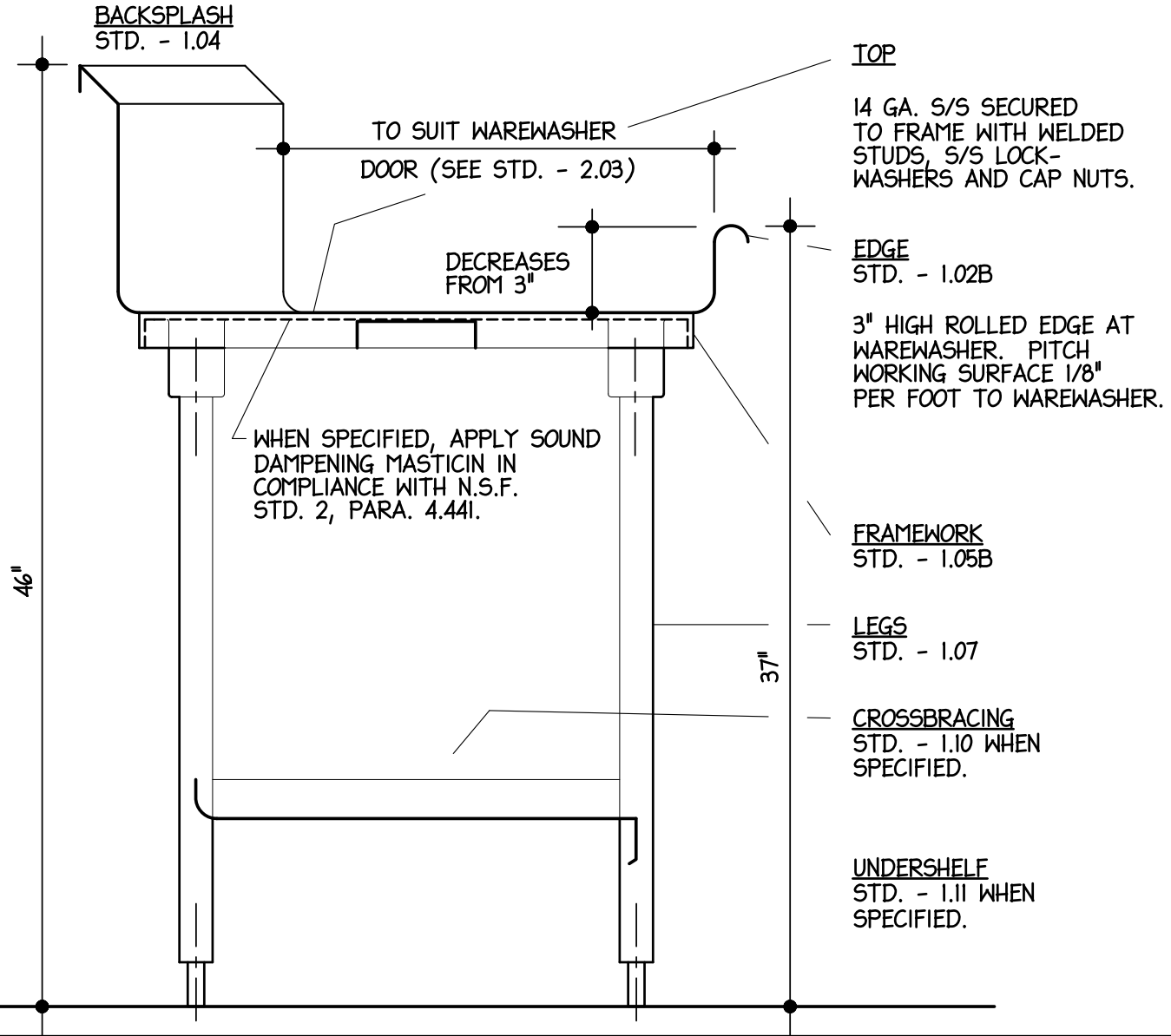
LEGS
STD. - 1.07

CROSSBRACING
STD. - 1.10 WHEN SPECIFIED.

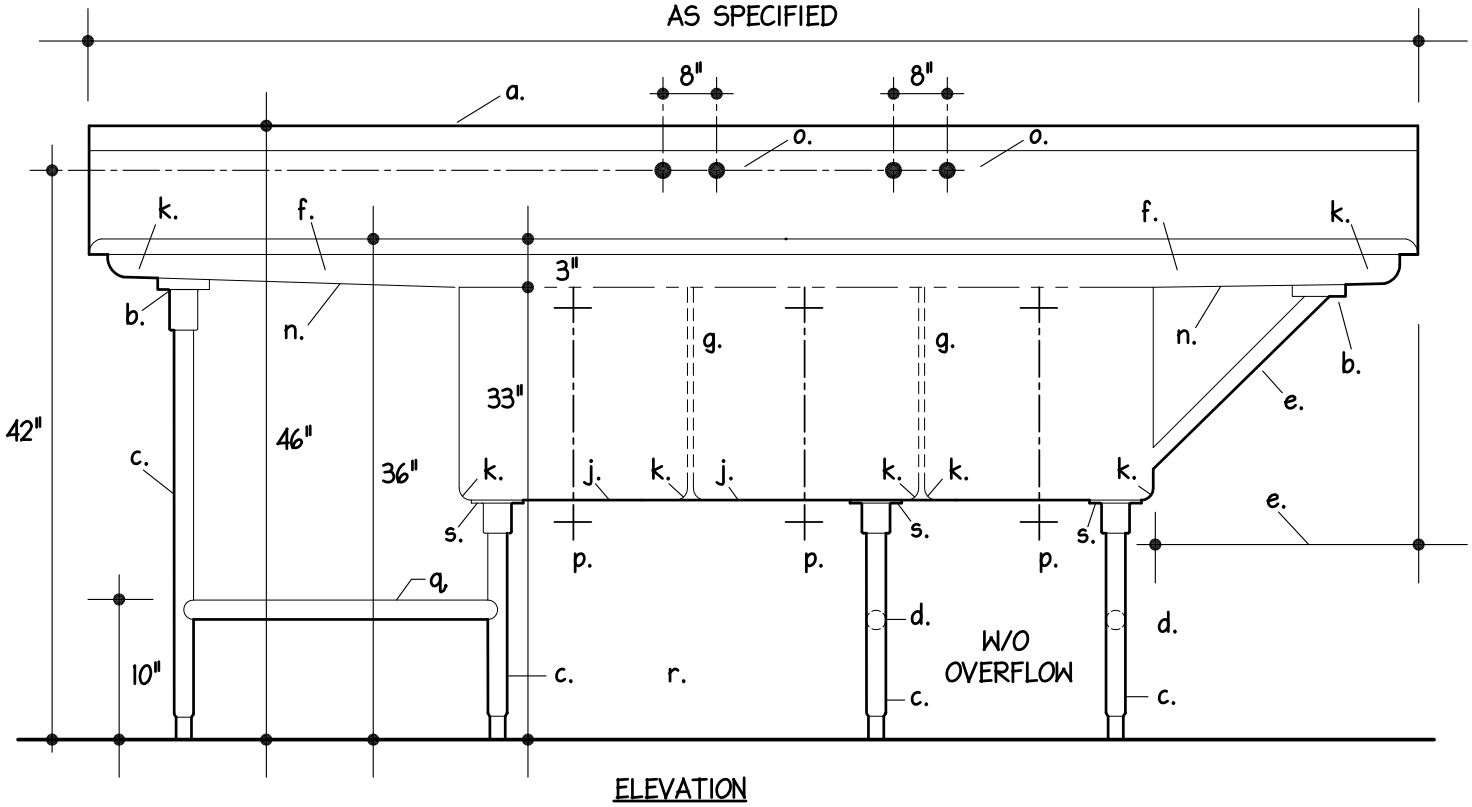
UNDERSHELF
STD. - 1.11 WHEN SPECIFIED.

NYIKOS ASSOCIATES, INC. Food Facilities Design/Consulting	DESCRIPTION: WORKTABLE	STANDARD DTL: 2.01
		PAGE: 114000-80

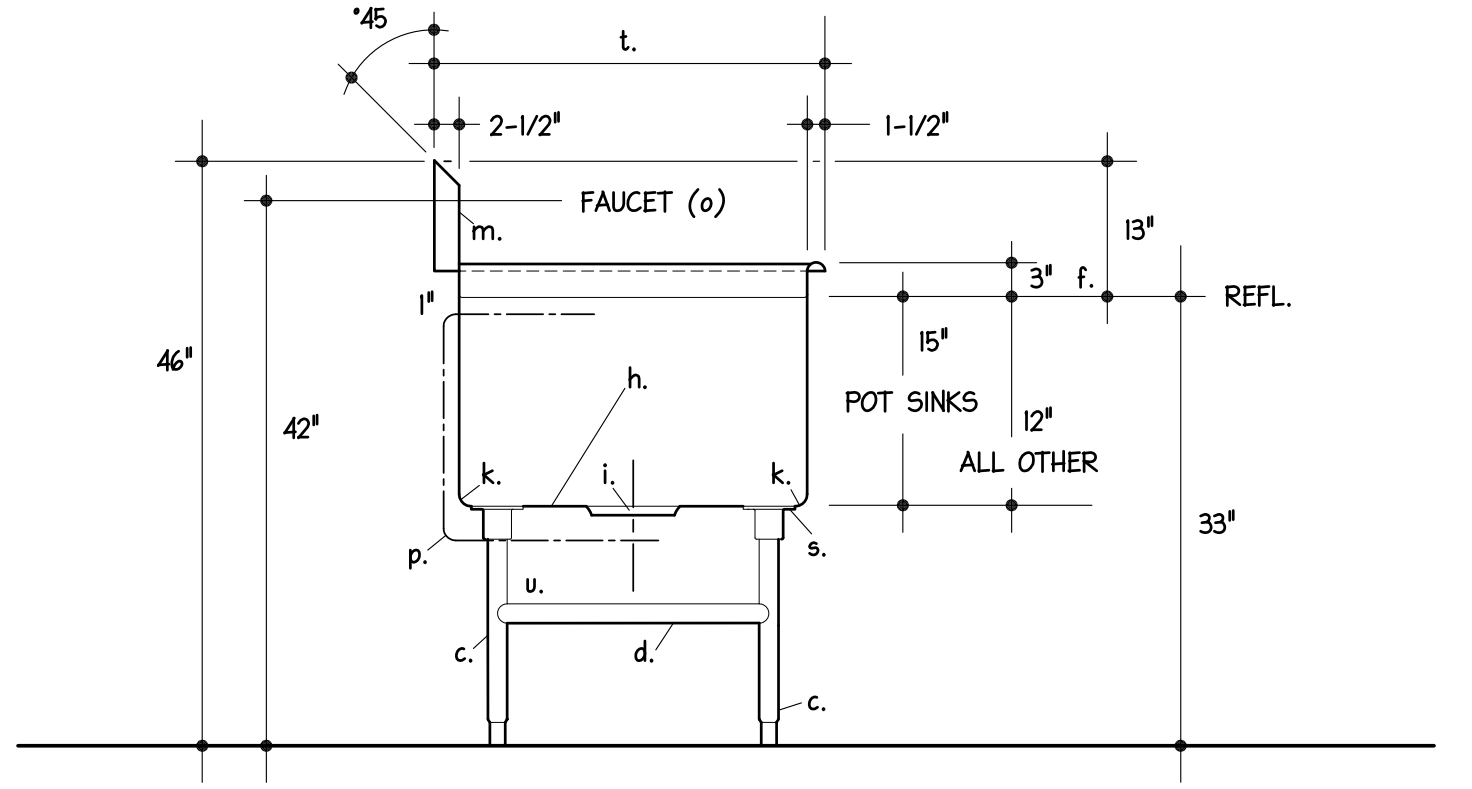




NYIKOS ASSOCIATES, INC. *Food Facilities Design/Consulting*	**DESCRIPTION:** **DISHTABLE**	**STANDARD DTL:** **2.02** **PAGE:** **114000-81**



ELEVATION



TYPICAL SECTION

a. MATERIAL - 14 GA. S/S.

b. STD. - 1.05c.

c. STD. - 1.07

d. STD. - 1.10

CONTINUED ON STD.- 3.01.1

e. DRAINBOARDS UP TO 24" IN LENGTH REQUIRE NO LEGS OR BRACES. DRAINBOARDS 25" TO 30" REQUIRE 1" O.D. 16 GA. S/S BRACE. DRAINBOARDS OVER 30" REQUIRE LEGS AND CHANNEL FRAMEWORK.

f. DRAINBOARDS SHALL PITCH TO SINK 1/8" PER FOOT OF LENGTH TO PROVIDE COMPLETE DRAINING WITHOUT POOLING. THE 3" HIGH RAISED ROLLED RIM AT THE SINK SHALL DECREASE IN HEIGHT TOWARD THE OUTER ENDS OF THE DRAINBOARD.

g. PARTITIONS BETWEEN COMPARTMENTS TO BE DOUBLE WALLED CONSTRUCTION WITH ROUNDED TOP, ALL WELDED INTEGRAL WITH SINK BODY.

h. BACK, BOTTOM, AND FRONT SHALL BE ONE CONTINUOUS PIECE WITH ENDS WELDED INTEGRAL, WITHOUT OVERLAPPING JOINTS OR OPEN SPACES, BETWEEN COMPARTMENTS.

i. WASTES SHALL BE SEATED IN DIE STAMPED DEPRESSIONS WITHOUT USE OF SOLDER, RIVETS OR WELDING. INSTALLED COMPONENTS SHALL BE FLUSH WITH SURROUNDING SURFACE.

j. EACH SINK COMPARTMENT TO BE PITCHED AND CREASED TO WASTE TO ASSURE COMPLETE DRAINING WITHOUT POOLING.

k. ENTIRE UNIT SHALL BE ALL WELDED COVE CORNERED CONSTRUCTION WITH VERTICAL AND HORIZONTAL AND INTERIOR CORNERS HAVING A 3/4" RADIUS.

l. STD.- 1.02 b EDGE.

m. STD. - 1.04a. BACKSPLASH.

n. UNDERSIDE OF DRAINBOARDS AND SINKS TO BE SPRAYED WITH SOUND DAMPENING IN COMPLIANCE WITH N.S.F. STD. 2 PARA 4.441 WHEN SPECIFIED.

o. FAUCETS - T¢S MODEL B-232 WITH AERATOR B-199, REMOVABLE MONEL SEATS AND 1/2" I.P.S. MALE INLETS.

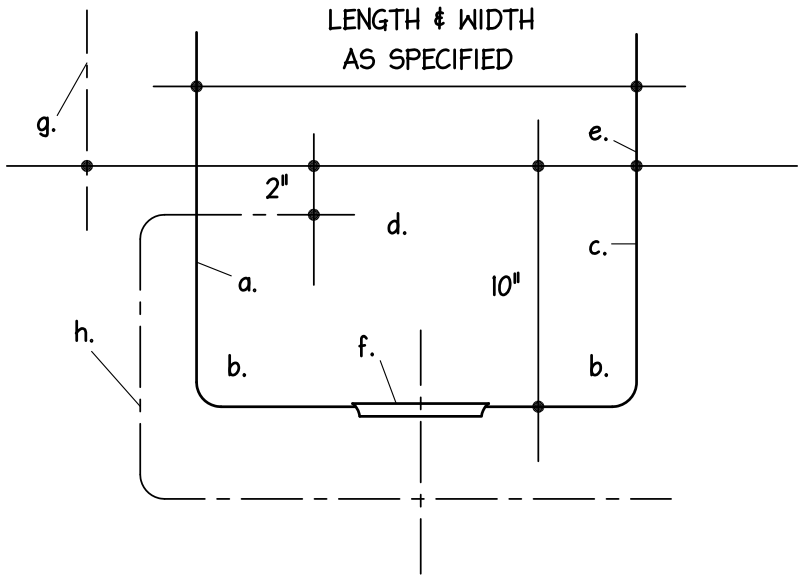
p. WASTES - 2" NICKEL PLATED BRONZE ROTARY HANDLE WASTE S/S STRAINER PLATE WITH CHROME WITH CHROME PLATED BRASS CONNECTED OVERFLOW, STANDARD- KIEL HARDWARE MFG. CO. #1770-1015-1000.

q, REAR CROSS BRACING ONLY.

r. OMIT FRONT AND REAR LENGTHWISE CROSSBRACIG UNDER SINKS.

s. 12 GAUGE STAINLESS STEEL 6"x 6" TRIANGULAR SUPPORT PLATE WELDED TO UNDERSIDE OF SINKS.

t. WIDTH AS SPECIFIED.



TYPICAL SECTION

a. MATERIAL - 14 GA. S/S

b. ENTIRE UNIT SHALL BE ALL WELDED COVE CORNERED CONSTRUCTION WITH VERTICAL AND HORIZONTAL AND INTERIOR CORNERS HAVING A 3/4" RADIUS.

c. TWO SIDES AND BOTTOM SHELL BE ONE CONTINUOUS PIECE WITH ENDS WELDED INTEGRAL WITHOUT OVERLAPPING JOINTS.

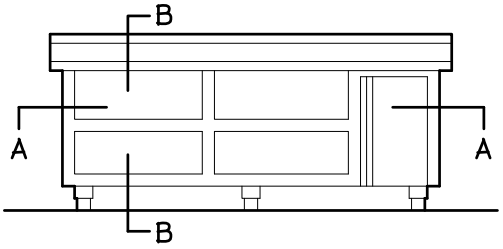
d. PARTITIONS BETWEEN COMPARTMENTS TO BE DOUBLE WALLED CONSTRUCTION WITH ROUNDED TOP, ALL WELDED INTEGRAL WITH SINK.

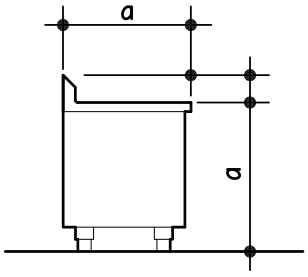
e. FULLY WELD SINK TO TOP WITHOUT OVERLAPPING JOINTS.

f. WASTES SHALL BE SEATED IN DIE STAMPED DEPRESSIONS WITHUOT USE OF SOLDER RIVETS OR WELDING . INSTALLED COMPONENTS SHALL BE FLUSH WITH SURROUNDING SURFACE.

g. FAUCET - T¢S MODEL B-222 FAUCET WITH B-199 AERATOR, REMOVABLE MONEL SEATS AND 1/2" IPS MALE INLETS.

h. WASTES - 1-1/2" NICKEL PLATED BRONZE ROTARY HANDLE WASTE AND S/S STRAINER PLATE WITH CHROME PLATED BRASS CONNECTED OVERFLOW, STANDARD-KEIL HARDWARE COMPANY NO. #1770-1015-1000.

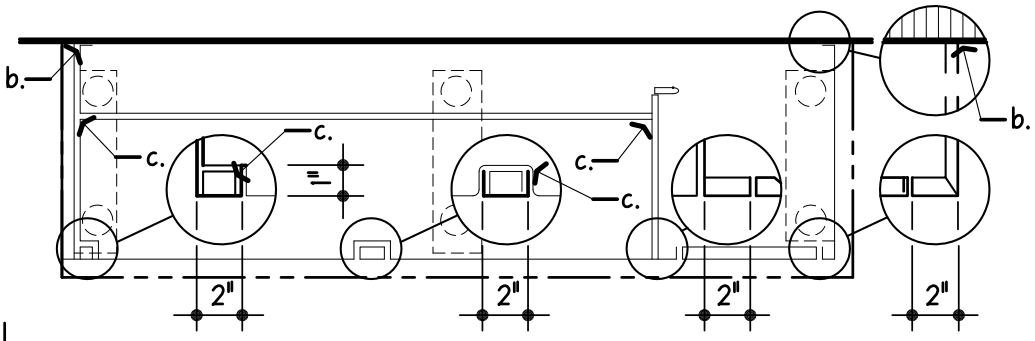




a. AS SPECIFIED

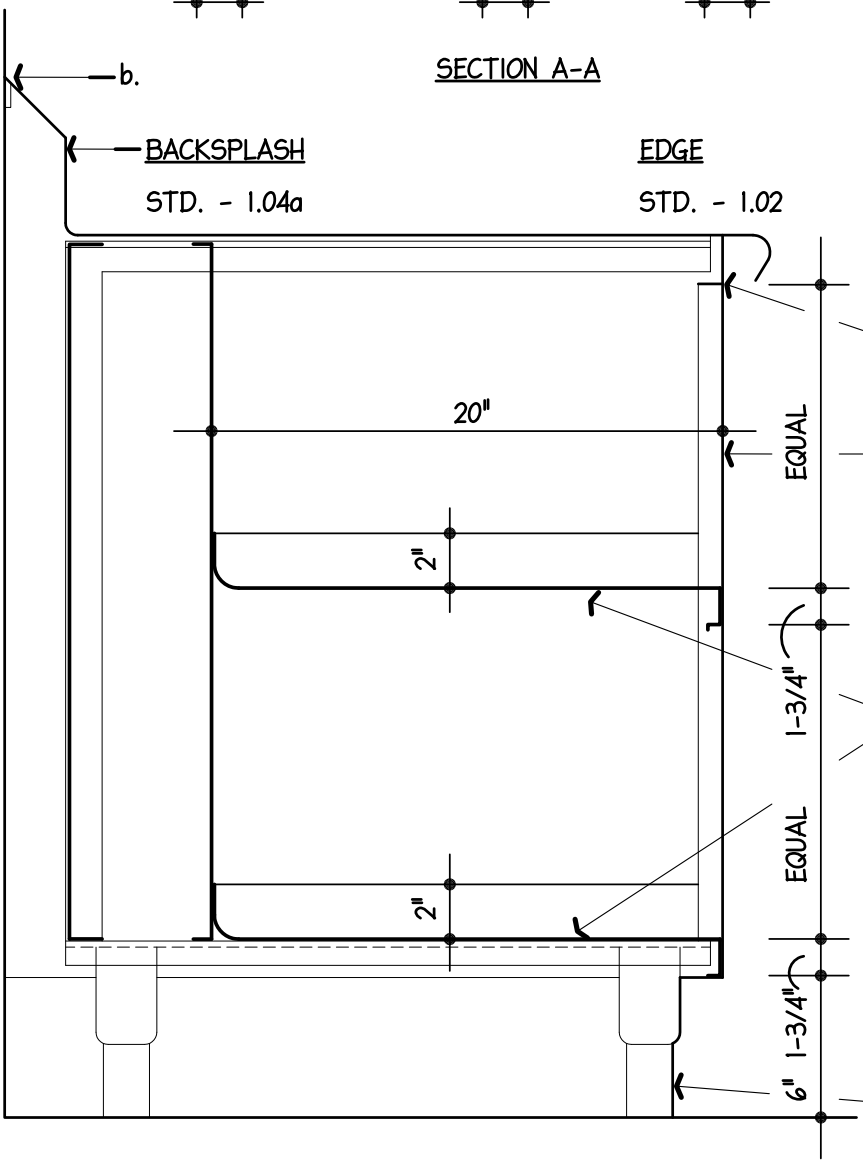
b. SEAL WITH SILICONE SEALANT

c. TIGHT JOINT. CLOSED BOTTOM.



NOTE!:
POP RIVETS & EXPOSED STUDS & CAP NUTS NOT ACCEPTABLE.

SECTION A-A



SECTION B-B

TOP

14 GA. S/S SECURED TO FRAMEWORK WITH WELDED STUDS, S/S L.W. AND CAP NUTS.

FRAMEWORK

STD. - 1.06

BODY

18 GA. S/S WITH INTEGRALLY FORMED STRUCTURAL ANGLES AND CHANNELS TACK WELDED.

SHELVES

16 GA. S/S SECURED TO LINER WITH TACK WELLS 1/2" LONG, 12" O/C.

DOOR

STD. - 4.25
- 4.26
- 4.27
- 4.28

LEGS

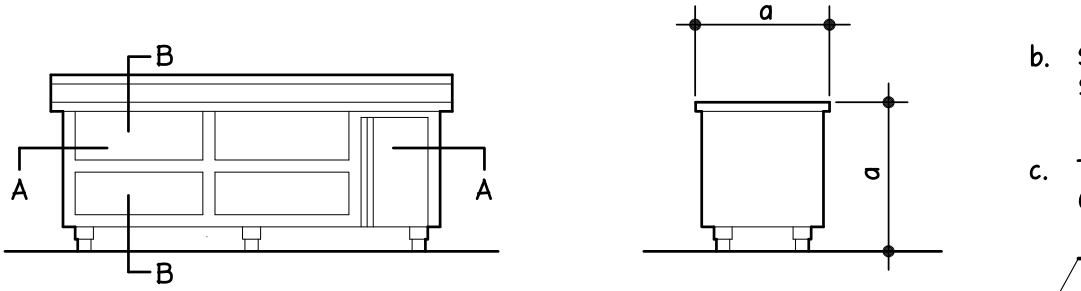
STD. - 1.08

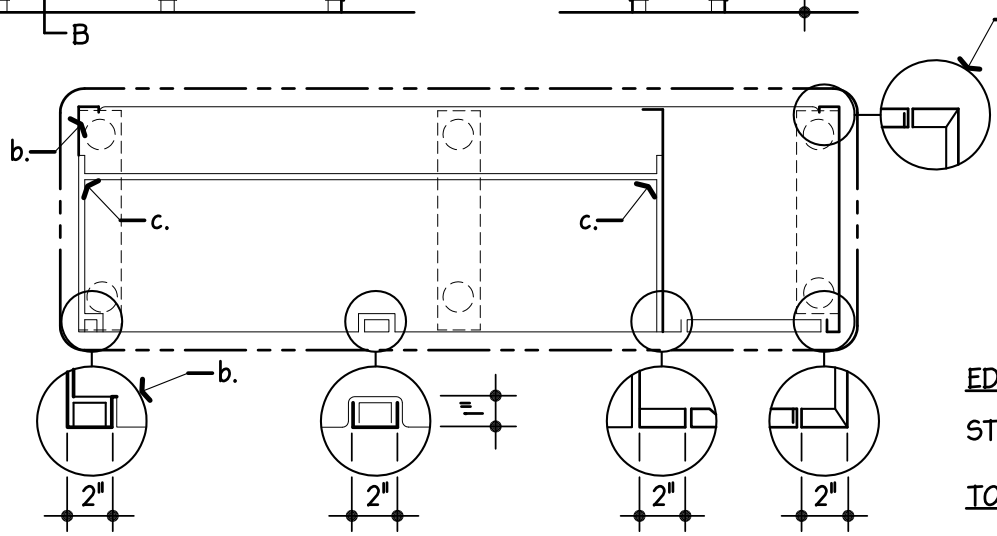
NYIKOS ASSOCIATES, INC. Food Facilities Design/Consulting	DESCRIPTION: BACK COUNTER	STANDARD DTL: 4.01
		PAGE: 114000-85

a. AS SPECIFIED

b. SEAL WITH SILICONE SEALANT

c. TIGHT JOINT. CLOSED BOTTOM.





SECTION A-A

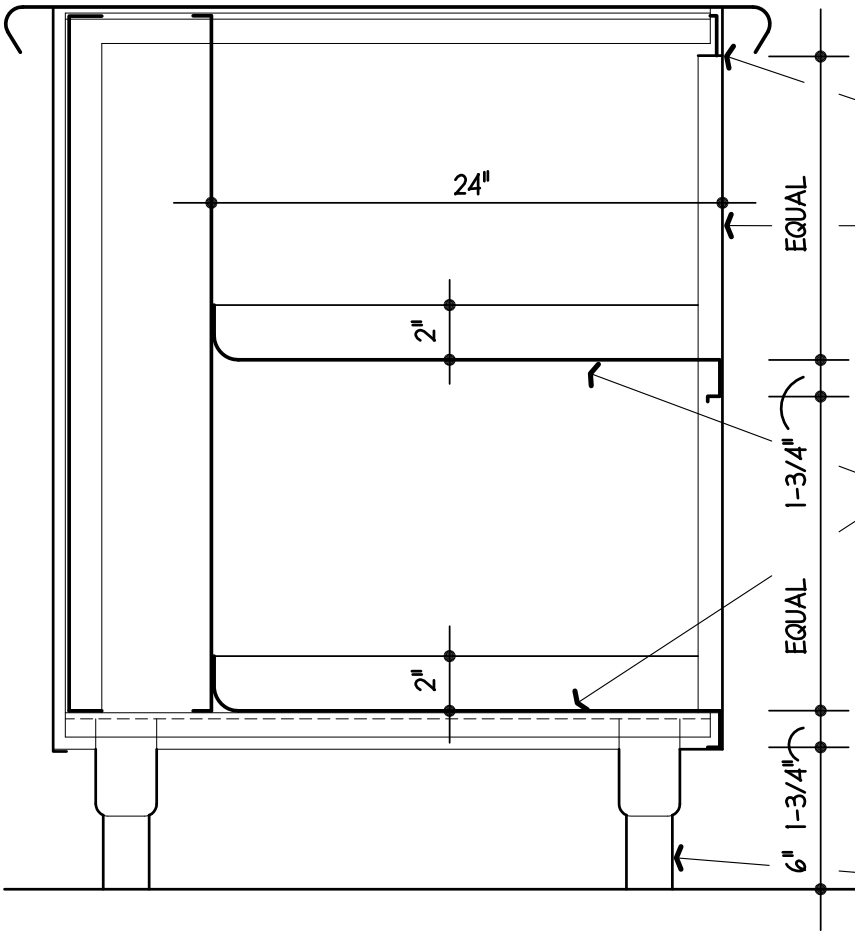
NOTE!:
POP RIVETS ¢
EXPOSED STUDS ¢
CAP NUTS NOT
ACCEPTABLE.

EDGE

STD. - 1.02

TOP

14 GA. S/S SECURED TO FRAMEWORK WITH WELDED STUDS, S/S L.W. AND CAP NUTS.



SECTION B-B

FRAMEWORK

STD. - 1.06

BODY

18 GA. S/S WITH INTEGRALLY FORMED STRUCTURAL ANGLES AND CHANNELS TACK WELDED.

SHELVES

16 GA. S/S

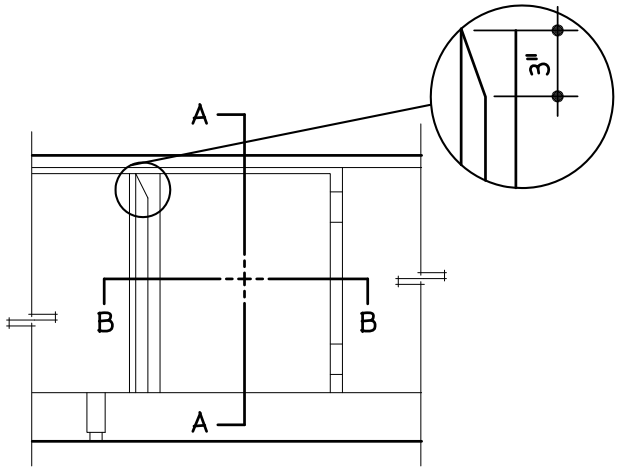
DOOR

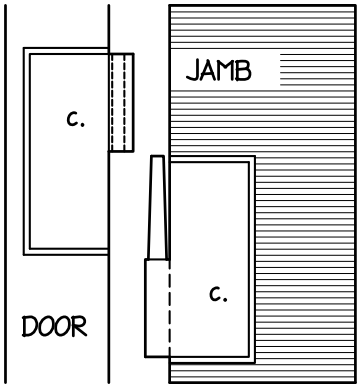
STD. - 4.25
- 4.26
- 4.27
- 4.28

LEGS

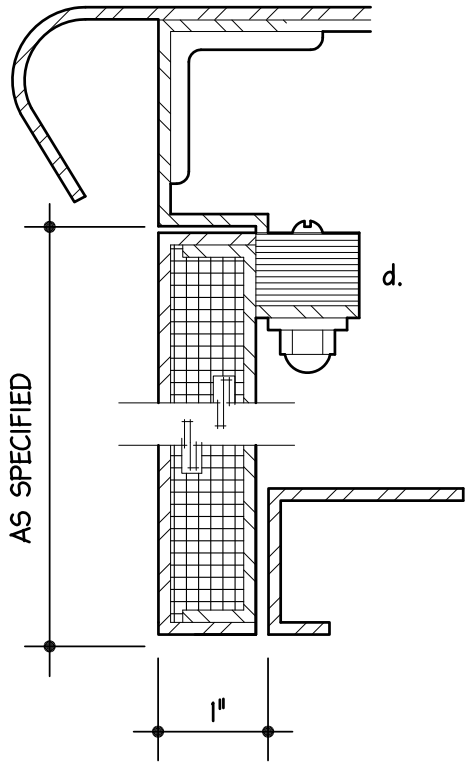
STD. - 1.08

NYIKOS ASSOCIATES, INC. Food Facilities Design/Consulting	DESCRIPTION: FREE STANDING COUNTER	STANDARD DTL: 4.02
		PAGE: 114000-86

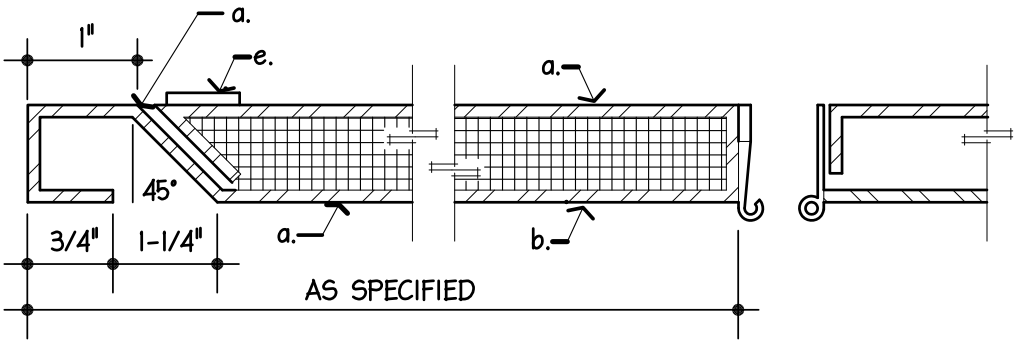




HINGE DETAIL



SECTION A-A



SECTION B-B

a. PANELING - 18 GA. S/S GA. EXTERIOR AND INTERIOR PANS TACK WELDED.

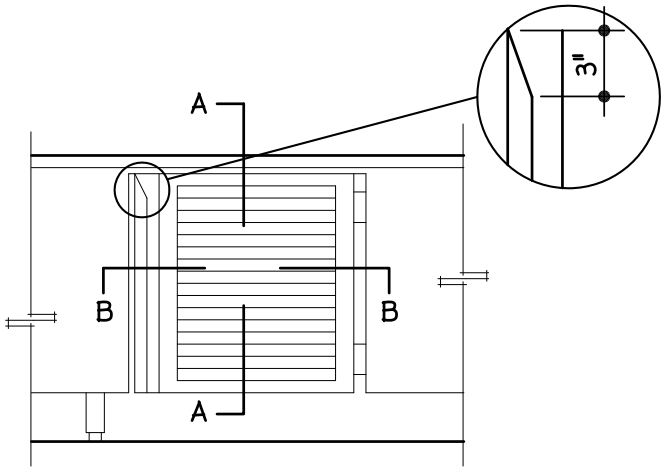
b. SEMI-RIGID FIBERGLASS SOUND DAMPENING.

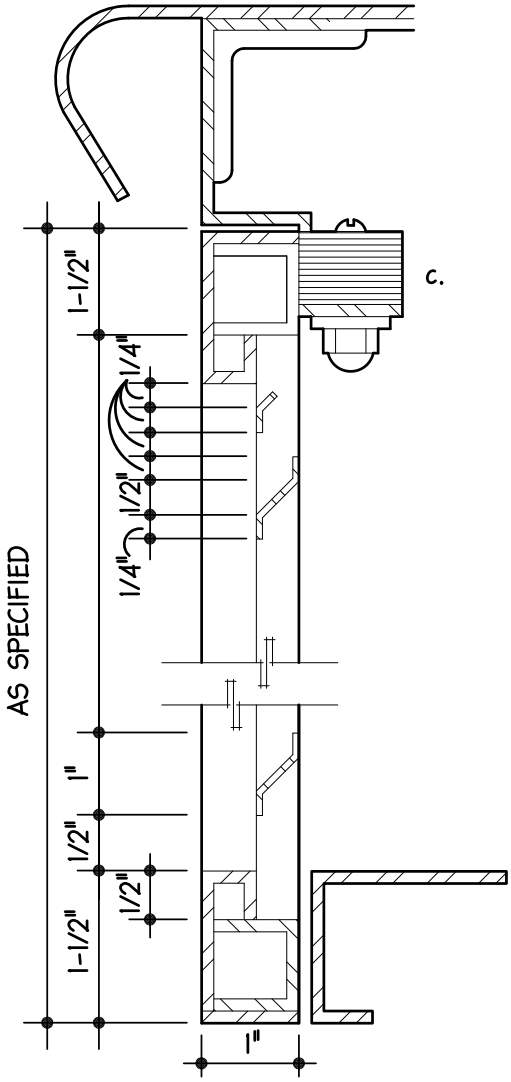
c. HEAVY-DUTY S/S CLIP JOINT HINGE AS MFD. BY STANDARD-KEIL. SET IN FLUSH WITH SURFACE OF DOOR AND JAMB AND WELDED IN PLACE.

d. STANDARD-KEIL #2932-1010-3000 MAGNETIC CATCH MOUNTED FLUSH IN CUT OUT ON 1" TURN DOWN.

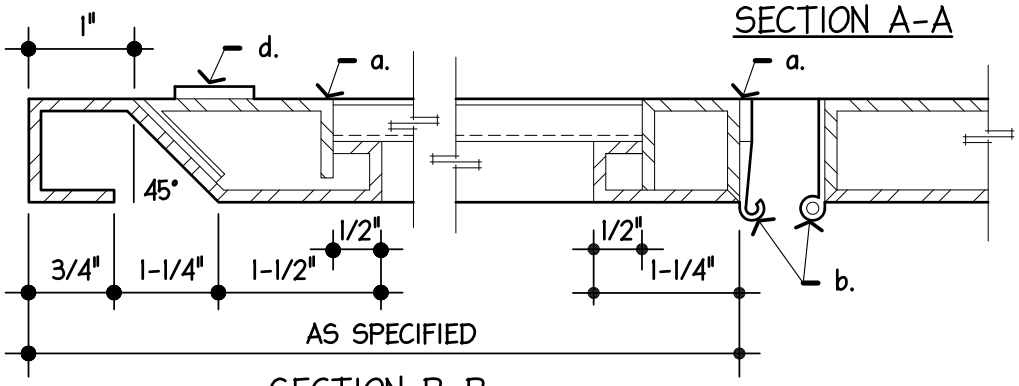
e. STEEL PLATE FOR MAGNETIC CATCH TACK WELDED TO INTERIOR DOOR PAN.

NYIKOS ASSOCIATES, INC. Food Facilities Design/Consulting	DESCRIPTION: **HINGED SOLID DOOR**	STANDARD DTL: **4.26** PAGE: **114000-87**





SECTION A-A



SECTION B-B

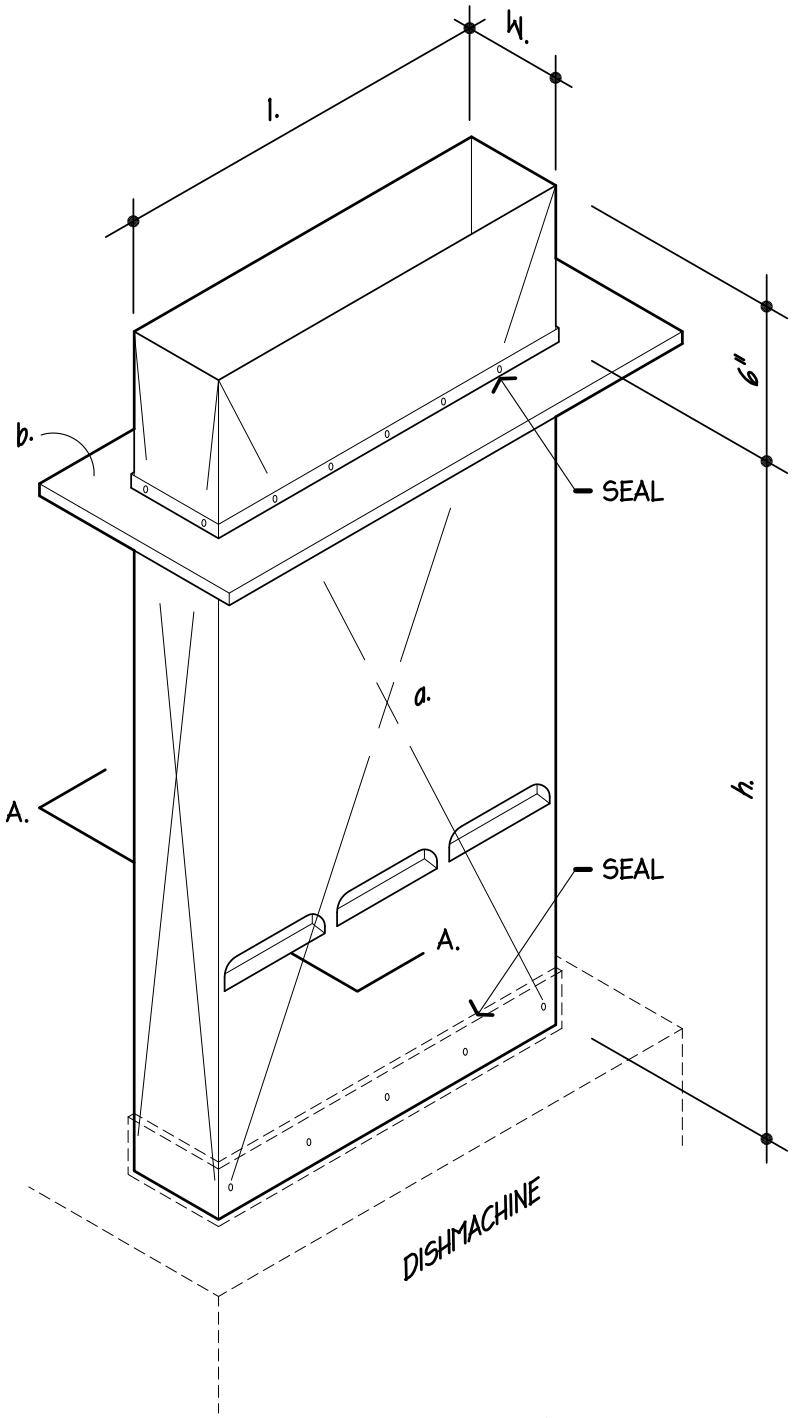
a. 18 GA. S/S GA. 18 GA. S/S EXTERIOR AND INTERIOR PANS TACK WELDED.

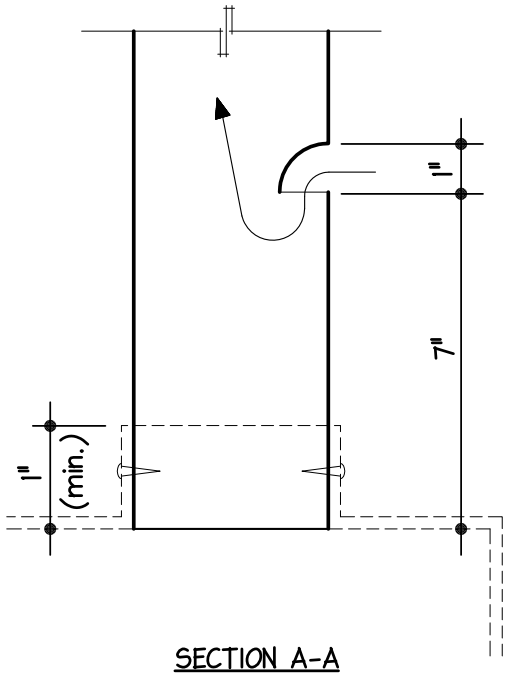
b. HEAVY-DUTY S/S CLIP JOINT HINGE AS MFD. BY KEELAN HARDWARE. SET IN FLUSH WITH SURFACE OF DOOR AND JAMB AND WELDED IN PLACE. RE: STD. - 4.26.

c. STANDARD-KEIL #2932-1010-3000 MAGNETIC CATCH MOUNTED FLUSH IN CUT OUT ON 1" TURN DOWN.

d. STEEL PLATE FOR MAGNETIC CATCH TACK WELDED TO INTERIOR DOOR PAN.

NYIKOS ASSOCIATES, INC. *Food Facilities Design/Consulting*	DESCRIPTION: **HINGED LOUVERED DOORS**	STANDARD DTL: **4.27** PAGE: **114000-88**





SECTION A-A

a. DUCT-18. GA. S/S WITH (3) 1" x 4" LOUVERS DIE STAMPED INWARD TO ALLOW FLOW OF COOL AIR FROM DISHWASHER. DUCT TO FIT TIGHT TO INSIDE OF VENT. SECURE WITH S/S SCREWS AND SEAL WITH SILICONE.

b. CEILING TRIM-18 GA. S/S, 1" x 2" ANGLE TRIM SECURED TO DUCT WITH SILICONE. PERIMETER CRIMPED TO PROVIDE A HUG-TIGHT EDGE TO CLG.

h. VERIFY. DUCTS OVER 60" SHALL BE CROSS CREASED FOR RIGIDITY.

l. ¢ w. l. DISHWASHER EXHAUST REQUIREMENTS. INCREASE DISHWASHER MANUFACTURERS CFM EXHAUST REQUIREMENTS FOR EACH VENT BY 50% TO ALLOW FOR AIR INDUCTION THROUGH DUCT VENTS.

c. EXHAUST DAMPER REQUIREMENTS. WHEN D.W. VENTS ARE NOT EQUIPPED WITH DAMPERS, EACH DUCT SHALL BE PROVIDED WITH AN 18 GA. S/S DAMPER AND LOCKING QUADRANT LOCATED BETWEEN THE LOUVERS AND D.W. VENT.

(END OF SECTION 114000)

SECTION 11 52 13

PROJECTION SCREENS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated projection screens.
2. Electrically operated projection screens and controls.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for metal support framing for projection screens.
2. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood backing for screen installation.
3. Division 26 “Electrical” Sections.

1.3 DEFINITIONS

A. Gain of Front-Projection Screens: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For projection screens. Show layouts and types of projection screens. Include the following:

1. For manually operated projection screens:

a. Drop lengths.
b. Anchorage details.
c. Accessories.

C. Samples:

1. Finishes of surface-mounted screen cases.
2. Screen viewing surface materials.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For projection screens to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations for Projection Screens: Obtain projection screens from single manufacturer. Obtain accessories, including necessary mounting hardware, from screen manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install projection screens until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.8 COORDINATION

A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, fire-suppression system, and partitions.

PART 2 - PRODUCTS

2.1 MANUALLY OPERATED PROJECTION SCREENS

A. General: Manufacturer's standard spring-roller-operated units, consisting of case, screen, mounting accessories, and other components necessary for a complete installation.

1. Screen Mounting: Top edge securely anchored to a 3-inch- diameter, rigid steel roller; bottom edge formed into a pocket holding a tubular metal slat, with ends of slat protected by plastic caps, and with a saddle and pull attached to slat by screws.

B. Surface-Mounted, Metal-Encased, Manually Operated Screens: Units designed and fabricated for surface mounting on wall or ceiling, fabricated from formed-steel sheet or from aluminum extrusions; with flat back design and powder-coated or satin aluminum finish. Provide units with matching end caps and concealed mounting.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Da-Lite Screen Company, Inc.; Model C with CSR.
b. Draper, Inc.; Luma 2.

2.2 FRONT-PROJECTION SCREEN MATERIAL

A. Matte-White Viewing Surface: Peak gain not less than 0.9, and gain not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.

B. Material: vinyl sheet.

C. Mildew-Resistance Rating: 0 or 1 when tested according to ASTM G 21.

D. Flame Resistance: Passes NFPA 701.

E. Edge Treatment: Black masking borders.

PART 3 - EXECUTION

3.1 FRONT-PROJECTION SCREEN INSTALLATION

A. Install front-projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.

1. Test manually operated units to verify that screen-operating components are in optimum functioning condition.

3.2 PROJECTION SCREEN SCHEDULE

A. Manually Operated, Front-Projection Screen Type PS-01: Surface mounted, metal encased.

1. Screen Surface: Matte white.
2. Viewing Surface Size (H x W): 69 inches x 92 inches.
3. Locations: As indicated on the Drawings.

B. Manually Operated, Front-Projection Screen Type PS-02: Surface mounted, metal encased.

1. Screen Surface: Matte white.
2. Viewing Surface Size (H x W): 105 inches x 140 inches.
3. Locations: Public Conference Room 350.

END OF SECTION 11 52 13

SECTION 11 65 00

Addendum #05

GYMNASIUM AND PLAY FIELD EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Gymnasium and Play Field Equipment:

1. Outdoor basketball backstops.
2. Outdoor basketball backboards.
3. Outdoor basketball goals.

1.2 RELATED SECTIONS

A. Division 5 (Division 05) Metals Sections: Structural steel and steel joists.

B. Division 9 (Division 09) Finishes Section: Finish painting of factory-primed surfaces.

1.3 REFERENCES

A. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM F 2440 – Standard Specification for Indoor Wall/Feature Padding.

C. Federal Standard 191 – Textile Test Methods.

D. NFPA 101 – Life Safety Code.

E. NFPA 255 – Surface Burning Characteristics of Building Materials.

F. NFPA 286 – Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

G. NFPA 701 – Methods of Fire Tests for Flame-Resistant Textiles and Films.

H. UL 214 – Test for Flame-Propagation of Fabrics and Films.

1.4 DESIGN REQUIREMENTS

A. Basketball Backstops: Locate overhead attachments of basketball backstops in keeping with static equivalent loading and point reactions.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including materials, components, fabrication, finish, and installation instructions.

B. Shop Drawings:
1. Submit manufacturer's shop drawings, including plans, elevations, sections, and details, indicating locations, quantities, dimensions, tolerances, materials, fabrication, connections, hardware, fasteners, finish, electrical wiring diagrams, options, and accessories.
2. Show location and detail of attachment to building structure.

C. Design Data:
   1. Basketball Backstops:
      a. Submit manufacturer's design data, indicating static loads and point reactions.
      b. Submit calculations complete, showing hanger and hoist pulley points.
      c. General load charts or generic product laboratory test data will not be considered sufficient data.

D. Test Reports: Submit manufacturer's certified test reports from testing performed by accredited independent testing laboratory, indicating compliance of materials with requirements as specified.

E. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

F. Manufacturer's Project References: Submit manufacturer's list of recently completed projects, including project name and location, name of architect, and type and quantity of gymnasium and play field equipment installed.

G. Operation and Maintenance Manual: Submit manufacturer's operation and maintenance manual; including operation, maintenance, adjustment, and cleaning instructions; trouble shooting guide; parts list; and electrical wiring diagrams.

H. Warranty: Submit manufacturer's standard, lifetime, and additional warranties.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Provide gymnasium and play field equipment from single manufacturer.

B. Manufacturer's Qualifications: Minimum of 5 consecutive years experience manufacturing gymnasium and play field equipment similar to that specified.

C. Installer's Qualifications: Trained and approved by manufacturer.

D. Regulatory Requirements: Gymnasium and play field equipment shall conform to latest rules and regulations.

   1. International Basketball Federation / Federation International de Basketball (FIBA).
   2. National Association for Girls and Women in Sport (NAGWS).
   3. National Basketball Association (NBA).
   4. National Collegiate Athletic Association (NCAA).
   5. National Federation of State High School Associations (NFHS).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions. Keep temporary protective coverings in place.

C. Handling: Protect materials and finish from damage during handling and installation.

1.8 WARRANTY

A. Provide 1-year warranty against defects in materials and workmanship, unless otherwise specified.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Porter Athletic, Inc., 601 Mercury Drive, PO Box 1790, Champaign, Illinois 61824-1790. Toll Free (888) 277-7778. Phone (217) 367-8438. Fax (217) 239-2255. Web Site www.porterathletic.com. E-Mail porter@porterathletic.com, or approved equal.

2.2 OUTDOOR BASKETBALL BACKSTOPS

A. Outdoor Basketball Backstops: Model No. R-176-8 outdoor backstop.
   1. Backstop: 5-9/16-inch O.D. gooseneck upright and 6-foot extension. Complete with support post system, backboard, and goal with net.
   2. Face of Backboard: 6'-0" extended from center line of formed upright support.
   3. Upright Support: 5-9/16-inch O.D. heavy-wall galvanized pipe formed to approximate 24-inch radius.
   4. Vertical Section: Extend 3'-7" into concrete footing and secured with anchor pin.
   5. Horizontal Section: Fabricated with slotted mounting plate to level backboard and goal.
   6. Bolts from Front-Mounted Goal: Mount directly through backboard and into Center-Strut mounting plate to eliminate strain on bank, should player hang on front-mounted goal.

2.3 OUTDOOR BASKETBALL BACKBOARDS

A. Outdoor Basketball Backboards: Model No. 00216000 rectangular-shaped, fiberglass backboard.

2.4 OUTDOOR BASKETBALL GOALS

A. Outdoor Basketball Goals: Model No. 236H00 Indoor/Outdoor Powr-Flex II Goal.
   1. Provide each outdoor backstop with goal.
   2. Net: White nylon net.
   3. Mounting Hardware: Plated.
   4. Finish: Official orange powder coated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and supporting structure to receive gymnasium and play field equipment. Notify Architect in writing of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install gymnasium and play field equipment in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Install equipment plumb, level, straight, square, accurately aligned, correctly located, to proper

elevation, and secure.

C. Install equipment using manufacturer's supplied hardware and fasteners.

F. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

G. Remove and replace damaged components that cannot be successfully repaired, as determined by Architect.

3.3 ADJUSTING

A. Adjust basketball backstops, backboards, and goals for plumb and level.

3.4 CLEANING

A. Clean gymnasium and play field equipment promptly after installation in accordance with manufacturer's instructions.

B. Remove labels and temporary protective coverings.

C. Do not use harsh cleaning materials or methods that would damage finish.

3.5 DEMONSTRATION

A. Demonstrate operation and maintenance of gymnasium and play field equipment to Owner's personnel.

B. Furnish Owner with keys to equipment after demonstration.

3.6 PROTECTION

A. Protect installed gymnasium and play field equipment to ensure equipment will be without damage or deterioration at time of substantial completion.

END OF SECTION 11 65 00

SECTION 11 68 00

Addendum #05

PLAY FIELD EQUIPMENT AND STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes playground equipment as follows:

1. Freestanding playground equipment.
2. Composite playground equipment.

1.3 DEFINITIONS

A. Definitions in ASTM F 1487 apply to Work of this Section.

B. IPEMA: International Play Equipment Manufacturers Association.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of playground equipment.

1. Include plans, elevations, sections, and attachment details.
2. Include fall heights and use zones for playground equipment, coordinated with the critical-height values of protective surfacing specified in Section 321816.13 "Playground Protective Surfacing."

C. Samples for Initial Selection: For each type of exposed finish.

1. Manufacturer's color charts.
2. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following products:

1. Include Samples of accessories to verify color and finish selection.
2. Posts and Rails: Minimum 6 inches long.

3. Platforms: Minimum 6 inches square.
4. Molded Plastic: Minimum 3 inches square.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of playground equipment.

C. Material Certificates: For the following items:

1. Shop finishes.
2. Wood-Preservative Treatment: Include certification by treating plant that states type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

D. Field quality-control reports.

E. Sample Warranty: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Five years from date of Substantial Completion.

KEVIN KAMENETZ
County Executive

EDWARD C. ADAMS, JR., *Director*
Department of Public Works

August 19, 2015

RE: Contract #15025 PO0
(Silver) Leeds Certified Green Building – Eastern Family Resource Center
9150 Franklin Square Drive, Baltimore, Maryland 21237
Rosedale – District 14 c 6
Job Order No. 249-218-0100-0614

ADDENDUM NO. 8
To All Bidders

This addendum is hereby made a part of the Proposal and the Special Provisions, and is hereby incorporated into the Contract. Should this addendum conflict with any portion of the Special Provisions, the Proposal, or any prior addenda, this addendum shall supersede and control.

Please note the attached changes, corrections, and/or information in connection with the contract and submit bids and be otherwise governed accordingly.

In the Specifications

Please note: In Addendum No. 6, Page 944 G was revised. The foot note ***should read*** Addendum No. 6 not Addendum No. 5. Please remove and replace.

Vincent G. Kicas, Chief
Division of Construction Contracts Administration

VGK:KM:AEC:bjw

Attachment - 1

Please acknowledge this Emailed Addendum by signing below and faxing back to Tony Crews at 410-887-4505. "Failure by a Bidder to acknowledge receipt of this Addendum to the County may result in the Bidder's bid being considered non-responsive and rejected."

RECEIVED BY: _____ **DATE:** _____

NAME ABOVE PRINTED: _____

COMPANY NAME PRINTED: _____

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain playground equipment from single source from single manufacturer.

B. Playground equipment and components shall have the IPEMA Certification Seal.

C. The following playground equipment and components shall have the IPEMA Certification Seal:

1. All proposed equipment

2.2 PERFORMANCE REQUIREMENTS

A. Safety Standard: Provide playground equipment according to ASTM F 1487.

2.3 FREESTANDING PLAYGROUND EQUIPMENT

A. Climber: Tri-Geo Climber (#ZZXX0131)

1. Frame: Manufacturer's standard galvanized-steel pipe or tubing.

2. Colors: As selected by Architect from manufacturer's full range.

B. Rocking/Springing Equipment:

1. Model: Spring Mates Turtle (#ZZXX0741)

a. Color: As selected by Architect from manufacturer's full range.

2. Model: Sidewinder Cycle with Sidecar (#ZZXX0584)

a. Color: As selected by Architect from manufacturer's full range.

3. Model: Whirligig (#ZZXX0043)

a. Color: As selected by Architect from manufacturer's full range.

2.4 COMPOSITE PLAYGROUND EQUIPMENT

A. Composite Play Structure: Integral play assembly that provides more than one play activity; manufactured as a system or assembled from manufacturer's standard modular-sized units.

1. Model: Mighty Fun Mountain (#PSD-1101-FTD)

2. Metal Frame: Galvanized-steel pipe or tubing connected with bolts or clamps.

a. Main Frame Posts: Not less than 4-inch OD.
b. Color: As selected by Architect from manufacturer's full range.

3. Platforms: Perforated metal.

PART 2 - PRODUCTS

See revisions
Addendum #08

2.1 MANUFACTURERS

A. Source Limitations: Obtain playground equipment from single source from single manufacturer.

B. Playground equipment and components shall have the IPEMA Certification Seal.

C. The following playground equipment and components shall have the IPEMA Certification Seal:

1. All proposed equipment

2.2 PERFORMANCE REQUIREMENTS

A. Safety Standard: Provide playground equipment according to ASTM F 1487.

2.3 FREESTANDING PLAYGROUND EQUIPMENT

A. Climber: Tri-Geo Climber (#ZZXX0131)

1. Frame: Manufacturer's standard galvanized-steel pipe or tubing.

2. Colors: As selected by Architect from manufacturer's full range.

B. Rocking/Springing Equipment:

1. Model: Spring Mates Turtle (#ZZXX0741)

a. Color: As selected by Architect from manufacturer's full range.

2. Model: Sidewinder Cycle with Sidecar (#ZZXX0584)

a. Color: As selected by Architect from manufacturer's full range.

3. Model: Blast Off (#ZZXX0594)

a. Color: As selected by Architect from manufacturer's full range.

2.4 COMPOSITE PLAYGROUND EQUIPMENT

A. Composite Play Structure: Integral play assembly that provides more than one play activity; manufactured as a system or assembled from manufacturer's standard modular-sized units.

1. Model: Design A (#ZZPD5020).

2. Metal Frame: Galvanized-steel pipe or tubing connected with bolts or clamps.

a. Main Frame Posts: Not less than 4-inch OD.
b. Color: As selected by Architect from manufacturer's full range.

3. Platforms: Perforated metal.

a. Color: As selected by Architect from manufacturer's full range.

4. Roofs: Plastic

a. Color: As selected by Architect from manufacturer's full range.

5. Play Structure Access Component(s): Ladder, Stairs.

a. Handholds: Protective barriers, Handrails.

6. Arrangement: As indicated on Drawings.

B. Composite Play Structure: Integral play assembly that provides more than one play activity; manufactured as a system or assembled from manufacturer's standard modular-sized units.

1. Model: Up & Down (#500-1008).

2. Metal Frame: Galvanized-steel pipe or tubing connected with bolts or clamps.

a. Main Frame Posts: Not less than 4-inch OD.
b. Color: As selected by Architect from manufacturer's full range.

3. Platforms: Perforated metal.

a. Color: As selected by Architect from manufacturer's full range.

4. Play Structure Access Component(s): Ladder, Stairs.

a. Handholds: Protective barriers, Handrails.

5. Arrangement: As indicated on Drawings.

2.5 FABRICATION

A. Provide sizes, strengths, thicknesses, wall thickness, and weights of components as required to comply with requirements in ASTM F 1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structures, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required for equipment indicated.

B. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing with cross-section profile and dimensions as required. Unless otherwise indicated, provide each pipe or tubing main-frame member with manufacturer's standard drainable bottom plate or support flange. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

C. Wood Frame: Fabricate main-frame upright support posts from wood. Fabricate secondary frame members, bracing, and connections from wood, steel, or aluminum.

D. Composite Frame: Fabricate main-frame upright support posts from metal and plastic. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

E. Play Surfaces: Manufacturer's standard elevated drainable decks, platforms, landings, walkways, ramps, and similar transitional play surfaces, designed to withstand loads; fabricated from perforated or expanded metal made into floor units with slip-resistant finish. Fabricate units in modular sizes and shapes to form assembled play surfaces indicated.

F. Protective Barriers: Fabricate according to ASTM F 1487. Extend barriers to height above the protected elevated surface according to requirements for use by age group indicated. Fabricate from[**one or more of**] the following:

1. Welded-metal pipe or tubing with vertical bars.
2. Steel sheet with openings for vision and ventilation.
3. Metal-pipe or -tubing frame with wire-mesh infill panels.
4. Opaque plastic panels with openings.
5. Vertical wood balusters with metal pipe or tubing or wood frame.
6. Wood panels with openings for vision and ventilation.

G. Guardrails: Provide guardrails configured to completely surround the protected area, except for access openings. Fabricate from welded metal pipe or tubing. Extend guardrails according to requirements for use by age group indicated.

H. Handrails: Welded metal pipe or tubing.

1. Provide handrails at heights to comply with requirements for use by age group indicated according to ASTM F 1487.

I. Roofs and Canopies: Designed to discourage and minimize climbing by users.

1. Fabricated from opaque plastic or polyethylene.

2.6 MATERIALS

A. Aluminum: Material, alloy, and temper recommended by manufacturer for type of use and finish indicated.

B. Steel: Material types, alloys, and forms recommended by manufacturer for type of use and finish indicated.

C. Stainless-Steel Sheet: Type 304; finished on exposed faces with No. 2B finish.

D. Opaque Plastics: Color impregnated, UV stabilized, and mold resistant.

E. Transparent Plastic: Abrasion-resistant, UV-stabilized polycarbonate sheet; not less than 3/16 inch thick.

F. Iron Castings and Hangers: Malleable iron, ASTM A 47/A 47M, Grade 32510, hot-dip galvanized.

G. Post Caps: color to match posts.

H. Platform Clamps and Hangers: not less than 0.105-inch-nominal thickness.

I. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a vandal-resistant design.

J. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or zinc-plated steel and iron, or stainless steel; permanently capped; and theft resistant.

2.7 CAST-IN-PLACE CONCRETE

A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete for normal-weight concrete.

B. Concrete Materials and Properties: Dry-packaged concrete mix complying with ASTM C 387/C 387M and mixed at site with potable water, according to manufacturer's written instructions, for normal-weight concrete with minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch-maximum-size aggregate.

2.8 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils, medium gloss. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 80 mils. Comply with coating manufacturer's written instructions for pretreatment and application.

2.9 IRON AND STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for pretreatment, applying, and baking.

B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 80 mils. Comply with coating manufacturer's written instructions for pretreatment and application.

2.10 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading required for placing playground equipment and protective surfacing is completed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.

1. Maximum Equipment Height: Coordinate installed fall heights of equipment with finished elevations and critical-height values of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

C. Post Set on Subgrade: Level bearing surfaces with drainage fill to required elevation.

D. Post Set with Concrete Footing: Comply with Section 033000 "Cast-in-Place Concrete" for measuring, batching, mixing, transporting, forming, and placing concrete.

1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.

a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

2. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.
3. Finishing Footings: Smooth top, and shape to shed water.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Perform inspection and testing for each type of installed playground equipment according to ASTM F 1487.

C. Playground equipment items will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

E. Notify Owner 48 hours in advance of date(s) and time(s) of testing and inspection.

END OF SECTION 11 68 00

DIVISION 12 – FURNISHINGS

SECTION 12 24 13

ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from

Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 WARRANTY

A. Warranty Period: Lifetime Limited Warranty. Fabrics warranted for 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Hunter Douglas Contract roller shades or comparable product by one of the following:

1. Draper Inc.
2. MechoShade Systems, Inc.

B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Direction of Shadeband Roll: Regular, from back of roller.
2. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Shadebands:

1. Shadeband Material: As indicated on the Drawings.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material.
b. Color and Finish: As selected by Architect from manufacturer's full range.

E. Installation Accessories:

1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.

    a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than 3 inches.

2. Endcap Covers: To cover exposed endcaps.
3. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller-shade manufacturer.
2. Type: 0.017 inches thick weighing 5.01 oz per square yard, comprising of 100% Polyester.
3. Roll Width: As required for each installation location.
4. Orientation on Shadeband: Up the bolt.
5. Openness Factor: 5 percent.
6. Color: As selected by Architect from manufacturer's full range.

C. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.

1. Source: Roller-shade manufacturer.
2. Type: 0.020 inches thick blackout material weighing 11.4 oz per square yard, comprising of 47% Polyester, 53% Acrylic.
3. Roll Width: As required for each installation location.
4. Orientation on Shadeband: Up the bolt.
5. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure

shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances,and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

SECTION 12 32 16

MANUFACTURED PLASTIC-LAMINATE-FACED CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes plastic-laminate-faced cabinets of stock design.

B. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood blocking for anchoring casework.
2. Section 09 22 16 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring casework.
3. Section 09 65 13 "Resilient Base and Accessories" for resilient base applied to plastic-laminate-faced casework.
4. Section 12 36 23.13 "Plastic-Laminate-Clad Countertops."
5. Section 12 36 61 “Simulated Stone Countertops” for solid-surface-material countertops.

1.3 DEFINITIONS

A. Definitions in the AWI's "Architectural Woodwork Standards" apply to the work of this Section.

B. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, and visible surfaces in open cabinets or behind glass doors.

1. Ends of cabinets indicated to be installed directly against and completely concealed by walls or other cabinets are defined as "concealed."

C. Semiexposed Surfaces of Casework: Surfaces behind opaque doors, such as cabinet interiors, shelves, and dividers; interiors and sides of drawers; and interior faces of doors. Tops of cases 78 inches or more above floor and bottoms of cabinets more than 24 inches but less than 48 inches above floor are defined as "semiexposed."

D. Concealed Surfaces of Casework: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

E. MDF: Medium-density fiberboard.

F. Hardwood Plywood: A panel product composed of layers or plies of veneer, or of veneers in combination with lumber core, hardboard core, MDF core, or particleboard core, joined with adhesive, and faced both front and back with hardwood veneers.

1.4 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that casework can be supported and installed as indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.
2. For adhesives and composite wood products, include documentation indicating that product contains no added urea formaldehyde resins.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show fabrication details, including types and locations of hardware. Show installation details, including field joints and filler panels. Indicate manufacturer's catalog numbers for casework.

C. Keying Schedule: Include schematic keying diagram and index each key set to unique designations that are coordinated with the Contract Documents.

D. Samples: For cabinet finishes.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Chain-of-Custody Certificates: Certificates indicating that products specified to be made from certified wood comply with forest certification and chain-of-custody requirements.

C. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

D. Sample Warranty: For special warranty.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer with a minimum of 10 years' experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this Project and that is certified for chain of custody by an FSC-accredited certification body.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation of units required for this Project and who is a certified participant in AWI's Quality Certification Program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework

must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.

B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period. Maintain temperature and relative humidity during the remainder of the construction period in range recommended for Project location by the AWI's "Architectural Woodwork Standards."

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of components or other failures of glue bond.
b. Warping of components.
c. Failure of operating hardware.

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Case Systems Inc.
2. LSI Corporation of America.
3. TMI Systems Design Corporation.

B. Source Limitations: Obtain plastic-laminate-faced cabinets from single manufacturer.

2.2 CASEWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the AWI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.

B. Certified Wood: Casework shall be produced from wood and wood products certified as "FSC Pure" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

C. Product Designations: Drawings indicate sizes, configurations, and finish materials of manufactured plastic-laminate-faced cabinets by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish materials, and complying with the Specifications may be considered. See Section 01 60 00 "Product Requirements."

D. Product Designations: Drawings indicate configurations of manufactured plastic-laminate-faced cabinets by referencing designations of Casework Design Series numbering system in Appendix A of the AWI's "Architectural Woodwork Standards."

2.3 CASEWORK

A. Design:

1. Flush overlay.

B. Grain Direction for Wood Grain Plastic Laminate:

1. Vertical on both doors and drawer fronts, with continuous vertical matching.
2. Lengthwise on face frame members.
3. Vertical on end panels.
4. Side to side on bottoms and tops of units.
5. Vertical on knee-space panels.
6. Horizontal on aprons.

C. Exposed Materials:

1. Plastic Laminate: Grade VGS.
2. Unless otherwise indicated, provide specified edgebanding on all exposed edges.

D. Semiexposed Materials:

1. Plastic Laminate: Grade VGS unless otherwise indicated. Provide plastic laminate for semiexposed surfaces unless otherwise indicated.

    a. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.
    b. Locations: Provide at exposed interior of casework such as open cabinets.

    c. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.

2. Unless otherwise indicated, provide specified edgebanding on all semiexposed edges.

E. Concealed Materials:

1. Solid Wood: Any hardwood or softwood species, with no defects affecting strength or utility.
2. Plywood: Hardwood plywood.
3. Plastic Laminate: Grade BKL.
4. Particleboard.

2.4 MATERIALS

A. Low-Emitting Materials: Fabricate casework, including countertops, with adhesives and composite wood products containing no added urea formaldehyde resins.

B. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated; made without added urea formaldehyde resins.

C. Softwood Plywood: DOC PS 1.

D. Particleboard: ANSI A208.1, Grade M-2; made with binder containing no added urea formaldehyde resins.

E. MDF: ANSI A208.2, Grade 130; made with binder containing no added urea formaldehyde resins.

F. Hardboard: ANSI A135.4, Class 1 Tempered.

G. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Formica Corporation.
b. Nevamar Decorative Surfaces; a Subsidiary of Panolam Industries International Inc.
c. Wilsonart LLC.

H. Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, 1 mm thick elsewhere.

2.5 COLORS AND FINISHES

A. Plastic-Laminate Colors, Patterns, and Finishes: As indicated on the Drawings by manufacturer's designations.

B. PVC Edgebanding Color: As selected from casework manufacturer's full range.

2.6 FABRICATION

1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard.

2. Shelves: 3/4-inch- thick particleboard up to 36 inches wide, 1-inch- thick particleboard over 36 inches wide.
3. Backs of Cabinets: 1/2-inch- thick particleboard or MDF where exposed, 1/4-inch hardboard dadoed into sides, bottoms, and tops where not exposed.
4. Drawer Fronts: 3/4-inch particleboard.
5. Drawer Sides and Backs: 1/2-inch particleboard or MDF, with glued dovetail or multiple-dowel joints.
6. Drawer Bottoms: 1/4-inch hardwood plywood glued and dadoed into front, back, and sides of drawers. Use 1/2-inch material for drawers more than 24 inches wide.
7. Doors 48 Inches High or Less: 3/4 inch thick, with particleboard or MDF cores and solid-wood stiles and rails.
8. Doors More Than 48 Inches High: 1-1/8 inches thick, with particleboard cores.

B. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.

C. Cabinet Subbase: Individual water-resistant exterior grade plywood with concealed fastening to cabinet bottoms.

1. Base to be 4 inches high unless otherwise indicated on the Drawings.

2.7 CASEWORK HARDWARE AND ACCESSORIES

A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware.

1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

B. Butt Hinges: Powder-coated, semiconcealed, five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.

C. Pulls: Solid aluminum wire pulls, fastened from back with two screws. For sliding doors, provide recessed stainless-steel flush pulls. Provide two pulls for drawers more than 24 inches wide.

D. Drawer Slides: BHMA A156.9, Type B05091.
1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated, steel ball-bearing slides.
2. Box Drawer Slides: Grade 1, for drawers not more than 6 inches high and 24 inches wide.
3. File Drawer Slides: Grade 1HD-100, for drawers more than 6 inches high or 24 inches wide.

E. Label Holders: Stainless steel, sized to receive standard label cards approximately 1 by 2 inches, attached with screws or brads.

1. Provide label holders at locations indicated on the Drawings.

F. Drawer and Hinged Door Locks: Cylindrical (cam) type, five-pin tumbler, brass with chrome-plated finish, and complying with BHMA A156.11, Grade 1.

1. Provide a minimum of two keys per lock and six master keys.
2. Provide locks on all doors and drawers.

G. Sliding-Door Hardware Sets: Manufacturer's standard, to suit type and size of sliding-door units.

H. Adjustable Shelf Supports: Two-pin locking plastic shelf rests complying with BHMA A156.9, Type B04013.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CASEWORK INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Install casework level, plumb, and true; shim as required, using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch. Bolt adjacent cabinets together with joints flush, tight, and uniform.

D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, framing, wood blocking, or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of 1/16 inch.

E. Fasten cabinets to adjacent cabinets and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI's "Architectural Woodwork Standards."

F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

G. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 CLEANING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 12 32 16

SECTION 12 36 23.13

PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes plastic-laminate countertops.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products and adhesive for bonding plastic laminate.

1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.
2. For installation adhesives, include a statement of VOC content in g/L.
3. For adhesives and composite wood products, documentation indicating that products contain no added urea formaldehyde resins.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in plastic-laminate countertops.
2. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: Plastic laminates, for each color, pattern, and surface finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Chain-of-Custody Certificates: Certificates indicating that products specified to be made from certified wood comply with forest certification and chain-of-custody requirements.

C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that countertops, including installation, comply with requirements of grades specified.

B. Grade: Custom.

C. Certified Wood: Plastic-laminate countertops shall be made from wood products certified as "FSC Pure" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

D. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Formica Corporation.

b. Nevamar Decorative Surfaces; a Subsidiary of Panolam Industries International Inc.
c. Wilsonart LLC.

E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by manufacturer's designations on finish schedule in Drawings.

F. Edge Treatment: Same as laminate cladding on horizontal surfaces.

G. Core Material: Exterior-grade plywood.

H. Core Thickness: 1 inch.

1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

I. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

J. Joints: No joints shall be closer than 24 inches to either side of the sink cutouts.

K. Backsplash: Unless otherwise indicated on drawings, all countertops shall be provided with 4 inch high back and side splashes where counters abut wall surfaces.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no added urea formaldehyde resins.

2. Softwood Plywood: DOC PS 1.

2.3 ACCESSORIES

A. Grommets for Cable Passage through Countertops: 1-1/4-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

2.4 MISCELLANEOUS MATERIALS

A. Adhesives: Do not use adhesives that contain added urea formaldehyde resins.

B. VOC Limits for Installation Adhesives and Sealants: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Multipurpose Construction Adhesives: 70 g/L.
3. Structural Wood Member Adhesive: 140 g/L.
4. Architectural Sealants: 250 g/L.

2.5 FABRICATION

A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c..
3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 12 36 23.13

SECTION 12 36 61

SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Solid-surface-material countertops and backsplashes.

B. Related Requirements:
   1. Section 22 40 00 " Plumbing Fixtures" for nonintegral sinks sinks and plumbing fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

   1. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.
   2. For adhesives and composite wood products used on the interior of the building, indicate that product contains no added urea formaldehyde resins.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples: For each type of material exposed to view.

   1. Countertop material, 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

A. Chain-of-Custody Certificates: Chain-of-custody certificates indicating that wood products comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.6 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.

B. Backsplashes: 1/2-inch- thick, solid surface material.

C. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
   1. Install integral sink bowls in countertops in the shop.

2.2 COUNTERTOP MATERIALS

A. Certified Wood Materials: Fabricate countertops with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

B. Particleboard: ANSI A208.1, Grade M-2 Exterior Glue, made with binder containing no added urea formaldehyde resins.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

D. Adhesives: Adhesives shall not contain added urea formaldehyde resins.

E. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Avonite Surfaces.
      b. E. I. du Pont de Nemours and Company.
      c. Formica Corporation.
      d. LG Chemical, Ltd.
      e. Meganite Inc.
      f. Samsung Chemical USA, Inc.
      g. Swan Corporation (The).
      h. Transolid, Inc.
      i. Wilsonart International.

   2. Type: Provide Standard Type unless Special Purpose Type is indicated.
   3. Integral Sink Bowls: Comply with ISSFA-2 and ANSI Z124.3, Type 5 or Type 6, without a precoated finish.
   4. Colors and Patterns: As indicated on Drawings by manufacturer's designations or, if not indicated, as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

1. Install backsplashes and endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
2. Seal edges of cutouts in particleboard subtops by saturating with varnish.

END OF SECTION 12 36 61

SECTION 12 48 13

ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roll-up rail mats.
2. Recessed frames.

1.3 COORDINATION

A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.

B. Shop Drawings:

1. Items penetrating floor mats and frames, including door control devices.
2. Divisions between mat sections.
3. Perimeter floor moldings.
4. Custom Graphics: Scale drawing indicating colors.

C. Samples: For each floor mat, tread rail, and frame member.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.2 ROLL-UP RAIL MATS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Reese Enterprises, Inc.; Perfec Roll-Up 3/4 inch Rollup Grate, or a comparable product by one of the following:

1. American Floor Products Company, Inc.
2. American Mat & Rubber Company.
3. Arden Architectural Specialties, Inc.
4. Balco, Inc.
5. Crowder, K. N. Manufacturing, Inc.
6. C/S Group.
7. Durable Corporation.
8. J. L. Industries, Inc.
9. Kadee Industries, Inc.
10. Musson Rubber Company.
11. Pawling Corporation; Architectural Products Division.

B. Roll-up, Aluminum-Rail Hinged Mats: Extruded-aluminum tread rails 1-1/2 inches wide by 3/4 inch thick, sitting on continuous vinyl cushions.

1. Tread Inserts: 1/4-inch- high, 28-oz./sq. yd. weight, level-cut, nylon-pile, fusion-bonded carpet.
2. Colors, Textures, and Patterns of Inserts: As selected by Architect from full range of industry colors.
3. Rail Finish: Black Anodized.
4. Hinges: Plastic.
5. Mat Size: As indicated on Drawings.

2.3 FRAMES

A. Recessed Frames: Manufacturer's standard extrusion.

1. Extruded Aluminum: ASTM B 221, Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.

a. Color: Black Anodized.

2.4 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.5 FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.

1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

C. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

2.6 ALUMINUM FINISHES

A. Mill finish.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.

1. Install necessary shims, spacers, and anchorages for proper location, and secure attachment of frames.
2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.3 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 12 48 13

SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Bicycle rack

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete".

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For units with factory-applied color finishes.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Size: Not less than 6-inch-long linear components and 4-inch- square sheet components
2. The owner may choose a different exposed finishes at no additional cost.

D. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

E. Material Certificates: For site furnishings, signed by manufacturers.

F. Maintenance Data: For site furnishings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of site furnishing(s) through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 BICYCLE RACK

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Victor Stanley, Inc.
2. Dumor, Inc.
3. Fairweather, Inc.

B. Bicycle Rack Construction:

1. Frame: Steel

a. Pipe OD: Not less than 2-3/8 inches.

2. Style: BRCS-105.

a. Capacity: Designed to accommodate no fewer than five bicycles.

3. Security: Designed to lock wheel and frame.
4. Installation Method: Cast in concrete.

C. Steel Finish: Powder Coat

1. Color: Red

END OF SECTION 12 93 00

SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Bicycle rack
2. Picnic Table
3. Bench

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete".

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For units with factory-applied color finishes.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Size: Not less than 6-inch-long linear components and 4-inch- square sheet components
2. The owner may choose a different exposed finishes at no additional cost.

D. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

E. Material Certificates: For site furnishings, signed by manufacturers.

F. Maintenance Data: For site furnishings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of site furnishing(s) through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 BICYCLE RACK

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Belson Outdoors, Inc.
2. Dumor, Inc.
3. Victor Stanley, Inc.
4. Fairweather, Inc.

B. Bicycle Rack Construction:

1. Frame: Steel

2. Style: BRG 18-P.

a. Length: 10’

3. Installation Method: Surface mount.

C. Steel Finish: Powder Coat

1. Color: Black

2.2 PICNIC TABLE

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Dumor, Inc.
2. Victor Stanley, Inc.
3. Fairweather, Inc.

B. Table Construction:

1. Frame: Steel

2. Style: 77-80PL.

3. Slats:
a. Color: Redwood

4. Installation Method: Surface mount.

C. Steel Finish: Powder Coat

1. Color: Black

2.3 BENCH

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Dumor, Inc.
2. Victor Stanley, Inc.
3. Fairweather, Inc.

B. Bench Construction:

1. Frame: Steel

    a. 3” square tube

2. Slats: Recycled plastic

    a. Color: Redwood

3. Style: 88 Series PL.

    a. Length: 6’

4. Installation Method: Cast in concrete.

C. Steel Finish: Powder Coat

1. Color: Black

END OF SECTION 12 93 00

DIVISION 14 – CONVEYING EQUIPMENT

14 21 00 Electric Traction Elevators

SECTION 14 21 00

ELECTRIC TRACTION ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes machine-roomless electric traction passenger and service elevators.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for temporary use of elevators for construction purposes.
2. Section 03 30 00 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
3. Section 04 20 00 "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
4. Section 05 50 00 "Metal Fabrications" for the following:

    a. Attachment plates and angle brackets for supporting guide-rail brackets.
    b. Divider beams.
    c. Hoist beams.
    d. Structural-steel shapes for subsills.
    e. Pit ladders.

5. Section 09 65 19 “Resilient Tile Flooring” for finish flooring in elevator cars.
6. Division 22 Specifications for sump pumps, sumps, and sump covers in elevator pits.
7. Division 27 Specifications for telephone service for elevators and for Internet connection to elevator controllers for remote monitoring of elevator performance.
8. Section 28 31 11 "Fire Detection and Alarm System" for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.

1.3 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

B. Service Elevator: A passenger elevator that is also used to carry freight.

1.4 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
2. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples: For exposed finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, and pit layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

1. The Elevator Contractor shall obtain and pay for necessary Municipal and State Inspection and permit as required by the elevator inspection authority, and make such tests as are called for by the regulations or such authorities. These tests shall be made in the presence of such authorities or their authorized representatives.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Elevator manufacturer shall be ISO 9002 certified.

B. Installer Qualifications: Elevator manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.9 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide KONE, Inc.; EcoSpace® gearless electric traction elevators with integrated controllers, or comparable product by one of the following:

1. Otis Elevator Co.
2. Schindler Elevator Corp.

B. Source Limitations: Obtain elevators from single manufacturer.

1. Major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44 and requirements of authorities having jurisdiction.

B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

C. Car Performance:

1. Car Speed ± 5% of contract speed under any loading condition or direction of travel.
2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

D. System Performance:

1. Vertical Vibration (maximum): 25 mg.
2. Horizontal Vibration (maximum): 25 mg.
3. Jerk Rate (maximum): 1.3 ft/sec^3.
4. Acceleration (maximum): 1.3 ft/sec^2.
5. In Car Noise: = 55 dB(A).
6. Leveling Accuracy: ± 0.2 inches.
7. Starts per hour (maximum): 120.

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description: Passenger Elevator

1. Passenger Elevators ELEV 1, ELEV 2
2. Machine Location: Hoistway; no machine room or closet is provided.
3. Rated Load: 3500 lb
4. Freight Loading Class for Service Elevator(s): Class A.
5. Rated Speed: 150 fpm.
6. Operation System: Group automatic operation.
7. Auxiliary Operations:

    a. Standby power operation.
    b. Automatic dispatching of loaded car.
    c. Nuisance call cancel.

8. Security Features: Card-reader operation.
9. Car Enclosures:

    a. Inside Height: 8’-0” to underside of ceiling.
    b. Front Walls (Return Panels): Satin stainless steel, No. 4 finish.
    c. Car Fixtures: Satin stainless steel, No. 4 finish.
    d. Side and Rear Wall Panels: Satin stainless steel, No. 4 finish.
    e. Reveals: Satin stainless steel, No. 4 finish.
    f. Door Faces (Interior): Satin stainless steel, No. 4 finish.
    g. Door Sills: Aluminum, mill finish.
    h. Ceiling: Satin stainless steel, No. 4 finish.
    i. Handrails: 1-1/2 inches round satin stainless steel, No. 4 finish, at sides and rear of car.
    j. Floor prepared to receive resilient flooring type VCT-3 (specified in Section 09 65 19 "Resilient Tile Flooring").

10. Hoistway Entrances:

    a. Width: 4'-0".
    b. Height: 8'-0".
    c. Type: Single-speed center opening.
    d. Frames: Satin stainless steel, No. 4 finish.
    e. Doors: Satin stainless steel, No. 4 finish.
    f. Sills: Aluminum, mill finish.

11. Hall Fixtures: Satin stainless steel, No. 4 finish.
12. Additional Requirements:

    a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish .
    b. Provide hooks for protective pads in all cars and one complete set of full-height protective pads.

C. Elevator Description: Service Elevator

1. Service Elevator Number(s): ELEV 3
2. Machine Location: Hoistway; no machine room or closet is provided.
3. Rated Load: 4500 lb.
4. Freight Loading Class for Service Elevator(s): Class A.
5. Rated Speed: 150 fpm.
6. Operation System: Selective-collective automatic operation.
7. Auxiliary Operations:

    a. Standby power operation.
    b. Battery-powered lowering.
    c. Automatic dispatching of loaded car.
    d. Nuisance call cancel.
    e. Independent service for service elevator.

8. Security Features: Card-reader operation.
9. Car Enclosures:

    a. Inside Height: 8'-0" to underside of ceiling.
    b. Front Walls (Return Panels): Satin stainless steel, No. 4 finish.
    c. Car Fixtures: Satin stainless steel, No. 4 finish.
    d. Side and Rear Wall Panels: Satin stainless steel, No. 4 finish.
    e. Reveals: Satin stainless steel, No. 4 finish.
    f. Door Faces (Interior): Satin stainless steel, No. 4 finish.
    g. Door Sills: Aluminum, mill finish.
    h. Ceiling: Satin stainless steel, No. 4 finish.
    i. Handrails: 1-1/2 inches round satin stainless steel, No. 4 finish, at sides and rear of car.
    j. Floor prepared to receive resilient flooring type VCT-3 (specified in Section 09 65 19 "Resilient Tile Flooring").

10. Hoistway Entrances:

    a. Width: 4'-0".
    b. Height: 8'-0".
    c. Type: Single-speed center opening.
    d. Frames: Satin stainless steel, No. 4 finish.

e. Doors: Satin stainless steel, No. 4 finish.
f. Sills: Aluminum, mill finish.

11. Hall Fixtures: Satin stainless steel, No. 4 finish.
12. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish .
b. Provide hooks for protective pads and one complete set of full-height protective pads.

2.4 TRACTION SYSTEMS

A. Elevator Machines: Variable-voltage, variable-frequency, ac-type hoisting machines or variable-voltage dc-type hoisting machines and solid-state power converters.

1. Provideregenerative or nonregenerativesystem.

B. Fluid for Hydraulic Buffers: If using hydraulic buffers, use only fire-resistant fluid.

C. Machine Beams: Provide framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Section 05 50 00 "Metal Fabrications" for materials and fabrication.

D. Car Frame and Platform: Bolted- or welded-steel units.

E. Guides: Roller guides or polymer-coated, nonlubricated sliding guides. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.

B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:

1. Single-Car Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby. Manual operation causes automatic operation to cease.
2. Group Standby Power Operation: On activation of standby power, cars are returned, one at a time, to a designated floor and parked with doors open. If a car cannot be returned, it is removed from the system. When all cars have been returned or removed from the system, one car can be put in service on standby power by a selector switch in control panel located at main lobby.
3. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors begin closing.
4. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
5. Loaded-Car Bypass: When car load exceeds 80 percent of rated capacity, car responds only to car calls, not to hall calls.

6. Distributed Parking: When cars are not required for response to calls, they are parked with doors closed and distributed in predetermined zones throughout the building. One zone shall include the main floor and adjacent floors; remaining floors shall be divided into approximately equal zones.

C. Security Feature: Security feature shall not affect emergency firefighters' service.

1. Card-Reader Operation: System uses card readers at car-control stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Provide stripe-swipe card reader integral with each car-control station.

a. Security access system equipment is specified in Section 28 13 00 "Access Control."

2.6 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

2.7 CAR ENCLOSURES

A. General: Provide steel-framed car enclosures with nonremovable wall panels, withcar roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Subfloor: Exterior, underlayment grade plywood, not less than 5/8-inch nominal thickness.
2. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
3. Fabricate car with recesses and cutouts for signal equipment.
4. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
5. Sight Guards: Provide sight guards on car doors.
6. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
7. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
8. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

2.8 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.

B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.

1. Fire-Protection Rating: 1 hour with 30-minute temperature rise of 450 deg F.

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:

1. Stainless-Steel Frames: Formed from stainless-steel sheet.
2. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches high, on both inside surfaces of hoistway door frames.
3. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
4. Sight Guards: Provide sight guards on doors matching door edges.
5. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
6. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.9 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with LEDs.

B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.

1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: Provide telephone jack in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Section 28 31 11 "Fire Detection and Alarm System."

E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

F. Hall Push-Button Stations: Provide hall push-button stations at each landing as indicated on Drawings.

1. Provide units with flat faceplate for mounting with body of unit recessed in wall.

2. Equip units with buttons for calling elevator and for indicating desired direction of travel.
3. Provide telephone jack in each unit for firefighters' two-way telephone communication service specified in Section 28 31 11 " Fire Detection and Alarm System."

G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

1. At manufacturer's option, audible signals may be placed on cars.

I. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.10 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

F. Aluminum Extrusions: ASTM B 221, Alloy 6063.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

F. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.

G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

H. Locate hall signal equipment for elevators as follows unless otherwise indicated:

1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance.
3. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

B. Apply for registration form for each elevator.

C. At least 15 days before a scheduled final acceptance inspection, submit to the Commissioner a written certification that:

1. The elevator meets the requirements of the elevator safety code.
2. A Third Party Qualified Elevator Inspector has certified that the elevator unit, as constructed and installed, complies with the Laws and Regulations of the State of Maryland.
3. The elements indicated on the inspection checklist are operational, have been tested, and are functional.

D. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).

B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

END OF SECTION 14 21 00

Bid Set
June 16, 2015

hord | coplan | macht

BALTIMORE COUNTY
EASTERN FAMILY RESOURCE CENTER

PROJECT MANUAL - VOLUME II

OWNER
Baltimore County Property Management
12200A Long Green Pike
Glen Arm, MD 21057
p. 410.887.3861

ARCHITECT & INTERIOR DESIGNER
Hord Coplan Macht, Inc.
750 E. Pratt Street, Suite 1100
Baltimore, MD 21202
p. 410.837.7311

CIVIL ENGINEER & LANDSCAPE ARCHITECT
A. Morton Thomas and Associates, Inc.
800 King Farm Blvd., 4th Floor
Rockville, MD 20850

KITCHEN CONSULTANT
Nyikos Associates, Inc.
18219-A Flower Hill Way
Gaithersburg, MD 20879
p. 240.683.9530

STRUCTURAL ENGINEER
Faisant Associates, Inc.
810 Light Street, Suite 100
Baltimore, MD 21230
p. 410.783.1696

M/E/P ENGINEER
Burdette Koehler Murphy & Associates, Inc.
1416 Clarkview Road
Baltimore, MD 21209
p. 410.323.0600

IT ENGINEER
Wright Engineering, LLC
853 Ripple Stream Court
Joppa, MD 21085
p. 410.877.6297

DIVISION 21 – FIRE PROTECTION

21 01 00 Fire Protection

SECTION 21 01 10

FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, general provisions of Contract, and other applicable Division-22 sections shall apply to this Section.

1.2 SUMMARY

A. This Section specifies automatic sprinkler and standpipe systems for buildings and structures. Materials and equipment specified in this Section include:

1. Pipe, fittings, valves, and specialties;
2. Sprinklers, fire department valve cabinets, and accessories.

B. Products furnished but not installed include sprinkler head cabinet with spare sprinkler heads. Furnish to the Owner's maintenance personnel.

1.3 DEFINITIONS

A. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).

B. Other definitions for fire protection systems are listed in the most current edition of NFPA Standards 13 and 14.

C. Working Plans as used in this Section means those documents (including drawings and calculations) prepared pursuant to the requirements contained in the most current edition of NFPA 13 for obtaining approval of the authority having jurisdiction.

1.4 SYSTEM DESCRIPTION

A. Fire Flow Test Data:

1. Flow Hydrant:

a.	Location:	Franklin Square Drive, 3rd Fire Hydrant East of Hospital Drive	
b.	Pitot Pressure:	32	PSI
c.	Outlet Diameter:	4 1/2	Inches
d.	Flow:	3075	GPM
e.	Nozzle Coefficient:	0.83	
f.	Corrected Flow:	2553	GPM
g.	Main Size:	12	Inches

2. Residual Hydrant:

a.	Location:	Franklin Square Drive, 2nd Fire Hydrant East of Hospital Drive	
b.	Static Pressure:	83	PSI
c.	Residual Pressure:	65	PSI
d.	Loss:	18	
e.	Loss at 20 PSI (140 kPa):	63	
f.	Main Size:	12	Inches

3. Date of Flow Test: May 1, 2014
4. The above information is for informational purposes only. The Contractor shall provide an independent flow test to confirm flow and pressure availability.

1.5 SUBMITTALS

A. Product Data: Include each type sprinkler head, valve, piping specialty, fire protection specialty, fire department connection, and fire department valve cabinet specified.

B. Shop Drawings: Submit drawings which have been prepared in accordance with the most current editions of NFPA, UL, FM, as well as the owner's insurance carrier requirements. Shop drawings shall include hydraulic calculations where applicable, and which have been approved by the authority having jurisdiction.

1. Sprinkler shop drawings shall be integrated into the Contractor's installation/coordination drawings.
2. Shop drawings shall include a written statement indicating compliance with all applicable requirements of NFPA, UL, FM, and the Owner's insurance carrier.

C. Coordination Drawings: Detail fire protection piping systems in accordance with Division-22 Section "Basic Plumbing Requirements." Fire protection piping shall be coordinated with work of all other trades.

D. Maintenance Data: For each type sprinkler head, valve, piping specialty, fire protection specialty, fire department connection, and fire department valve cabinet specified, include in operating and maintenance manual.

E. Quality Control Submittals:

1. Welders' qualification certificates. Submit for each qualified welder the following documentation according to AWS B2.1. Welding Procedure Specification (WPS), Procedure Qualification Record (PQR), Welder Qualification Record (WQR), verifying the AWS qualification within the previous six (6) months, or certified work history showing no break in work.
2. Test Reports and Certificates: Include "Contractor's Material & Test Certificate for Aboveground Piping" and "Contractor's Material & Test Certificate for Underground Piping" as described in the most current edition of NFPA 13.
3. Internal Inspection of Piping; where sprinkler piping is welded, an obstruction investigation will be conducted and report submitted.

F. Computer (CADD) files of drawings will not be made available to the Contractor for any purposes.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installation and alterations of fire protection piping, equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by a qualified installer having a minimum of five (5) years' experience with work similar in size and scope to this project.

B. Qualifications for Welding Processes and Operators: Comply with the requirements of AWS B2.1", Specifications for Qualifications of Welding Procedures and Welders for Piping and Tubing, Level AR-3."

C. Regulatory Requirements: Comply with the requirements of the most current edition of the following codes:

1. NFPA 13 - Standard for the Installation of Sprinkler Systems.
2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.
3. UL and FM Compliance: Fire protection system materials and components shall be Underwriter's Laboratories listed and labeled, and Factory Mutual approved for the application anticipated.
4. In addition to all regulatory requirements, the complete fire protection system shall meet the requirements of the Owner's insurance carrier.

D. Miscellaneous Materials:

1. Sprinkler Wrenches: Furnish to Owner, two (2) wrenches for each type of sprinkler head installed as provided by the sprinkler manufacturer.
2. Sprinkler Heads and Cabinets: Furnish six extra sprinkler heads of each style included in the project. Furnish each style with its own sprinkler head cabinet and special wrenches as specified in this Section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fire protection system products which may be incorporated in the work include the following:

1. Gate Valves:

a. Fairbanks
b. Jenkins
c. Kennedy Valve, Div of ITT Grinnell Valve Co., Inc.
d. Stockham

2. Swing Check Valves:

a. Fairbanks
b. Jenkins
c. Kennedy Valve, Div of ITT Grinnell Valve Co., Inc.

d. Star Sprinkler Corp.
e. Stockham
f. Victaulic

3. Grooved Mechanical Couplings:

a. Stockham
b. Victaulic

4. Water Flow Indicators:

a. Reliable Automatic Sprinkler Co., Inc.
b. Star Sprinkler Corp.
c. Viking Corp.

5. Electric Alarm Gong:

a. Star Sprinkler Corp.
b. Reliable Automatic Sprinkler Co., Inc.
c. Victaulic

6. Detector Check Valves:

a. Ames Company, Inc.
b. Kennedy Valve, Div of ITT Grinnell Valve Co., Inc.

7. Alarm Check Valve:

a. Reliable Automatic Sprinkler Co., Inc.
b. Star Sprinkler Corp.
c. Viking Corp.

8. Siamese Connection:

a. Guardian Fire Equipment, Inc.
b. Elkhart Brass

9. Fire Department Valve:

a. Guardian Fire Equipment, Inc.
b. Elkhart Brass

10. Sprinkler Heads:

a. Central Sprinkler Corp.
b. ITT Grinnell
c. Reliable Automatic Sprinkler Co., Inc.
d. Star Sprinkler Corp.
e. Viking Corp.
f. Victaulic

2.2 PIPING MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where more than one type of materials or products are indicated, selection is Installer's option. All products in a grooved system shall be of the same manufacturer.

2.3 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-22 section "Identification for Plumbing Piping and Equipment".

2.4 BASIC PIPES AND PIPE FITTINGS

A. General: Provide pipes and pipe fittings complying with Division-22 section "Pipe, Tube and Fittings for Plumbing Systems", in accordance with the following listing:

1. Pipe Size 2" (50 mm) and Smaller: Black steel pipe; Schedule 40; cast-iron threaded.
2. Pipe Size 2" (50 mm) and Smaller: Black steel pipe; Schedule 10; roll-grooved fittings.
3. Pipe Size 2-1/2" (65 mm) and Larger: Black steel pipe; Schedule 10; welded or grooved-end fittings, ductile iron.
4. “Weld-o-let” or “Thread-o-let” fittings shall be used for branch/runouts to sprinkler heads.
5. “U-bolt” clamps, Gruvlok clamps or socket type tees shall not be used and will not be acceptable.

2.5 BASIC VALVES

A. Gate Valves - 2 Inch (50 mm) and Smaller: Body and bonnet of cast bronze, 175 pound (1200 kPa) cold water working pressure - non-shock, threaded ends, solid wedge. outside screw and Yoke, rising stem, screw-in bonnet, and malleable ironhandwheel. Valves shall be capable of being repacked under pressure, with valve wide open.

B. Gate Valves - 2-1/2 Inch (65 mm) and Larger: Iron body; bronze mounted, 175 pound (1200 kPa) cold water working pressure - non-shock. Valves shall have solid taper wedge; outside screw and Yoke, rising stem; flanged bonnet with body and bonnet conforming to ASTM A 126 Class B; replaceable bronze wedge facing rings; flanged ends; and a packing assembly consisting of a cast iron gland flange, brass gland, packing, bonnet, and bronze bonnet bushing. Valves shall be capable of being repacked under pressure, with valve wide open.

C. Swing Check Valves: MSS SP-71; Class 175, cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends. Valve shall be capable of being refitted while the valve remains in the line.

2.6 SPECIALTY VALVES

A. Alarm Check Valve: 300 psig (2050 kPa) working pressure, designed for horizontal or vertical installations, and have ductile iron, grooved ends, bronze grooved seat with "O" ring seals, single hinge pin and latch design. Provide trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, precision retarding chamber, drip cup assembly piped without valves separate from main drain line, and fill line attachment with strainer.

B. Detector Check Valves: Galvanized cast iron body, with a bolted cover with air bleed device for access to internal parts; 175 psig (1200 kPa) working pressure. One piece bronze disc with bronze bushings, pivot and replaceable seat. Provide threaded bypass taps in the inlet and outlet for bypass meter connection. Valve shall be set to allow minimal water flow through the bypass meter; when major water flow is required, the water pressure will fully open the clapper.

2.7 AUTOMATIC SPRINKLERS

A. Sprinkler Heads: Fusible link or glass bulb type, and style as indicated or required by the application. All heads shall be UL/FM approved. For each application, all heads shall be of the same manufacturer. Unless otherwise indicated, provide heads with nominal 1/2 inch (13 mm) discharge orifice, for "Ordinary" temperature range.

B. Sprinkler Head Finishes: Provide heads with the following finishes:

1. Upright or Pendent Styles: Standard bronze finish for heads in unfinished spaces and not exposed to view. Heads shall be wax-coated where installed exposed to acids, chemicals, or other corrosive fumes.
2. Recessed Ceiling and Sidewall Styles: Bright chrome escutcheon plate.
3. Concealed Style: Rough brass and painted white cover, screwed-on adjustment plate.
4. Intermediate Level Style: Bright chrome.
5. Extended Coverage: bright chrome.
6. Institutional Style: Polished chrome with chrome escutcheon plate. Retaining flange shall be provided and installed.

C. Provide quick response sprinkler heads throughout the building.

D. Provide high temperature sprinkler heads in equipment spaces where pressure and temperature relief valve(s) are to be installed.

E. Sprinkler Head Cabinet and Wrench: Finished steel cabinet, suitable for wall mounting, with hinged cover and space for six (6) spare sprinkler heads plus sprinkler head wrench. Provide a separate cabinet for each style sprinkler head on the project.

2.8 FIRE DEPARTMENT VALVE CABINET

A. Cabinets for fire department valves shall be recessed aluminum with satin anodized finish. Door shall be 1/2" (13 mm) thick (hollow) with full glass window and 1-3/4" (45 mm) face trim. Valve cabinet shall be designed and installed to maintain the integrity of a 2-hour rated wall system in accordance with all applicable codes and standards.

2.9 FIRE DEPARTMENT VALVE

A. Fire Department valve shall be a 2-1/2" (65 mm) polished brass pressure reducing device capable of handling inlet pressures up to 300 psi (2040 kPa).

B. Valve shall be complete with removable 2-1/2" x 1-1/2" (65 mm x 40 mm) reducer, cap and chain.

2.10 SIAMESE CONNECTIONS

A. Wall Type Siamese Connections: Polished cast brass, flush wall type, with wall escutcheon and two-way connections. Connection sizes shall be 4 inch (100 mm) outlet and two 2-1/2 inch (65 mm) female inlets, having NH standard threads, for the connection size indicated, as specified in NFPA. Each inlet shall have a clapper valve, and plug and chain. Unit shall have wall escutcheon of cast brass, finish to match connections, with words "STANDPIPE" or "AUTO SPKR", or "AUTO SPKR & STANDPIPE" in raised letters.

2.11 ALARM DEVICES

A. General: Types and sizes shall mate and match piping and equipment connections.

B. Water Flow Indicators: Vane type waterflow detector, rated to 250 psig (1724 kPa); designed for horizontal or vertical installation; have 2-SPDT circuit switches to provide isolated alarm and auxiliary contacts, 7 ampere 125 volts AC and 2.5 ampere 24 Volts DC; complete with factory-set, field-adjustable retard element to prevent false signals, and tamper-proof cover which sends a signal when cover is removed.

C. Electric Alarm Gongs: 10 inch (250 mm) diameter cast aluminum gong, with factory-finish in red enamel; bell shall be weatherproof and listed for outdoor use by Underwriters Laboratories and Factory Mutual. Power supply shall be compatible with fire alarm control panel. Alarm bell shall be motor driven with under dome striker.

D. Supervisory Switches: SPST, normally closed contacts, designed to signal valve in other than full open position.

2.12 BACKFLOW PREVENTER (FIRE PROTECTION)

A. Provide double check detector assembly consisting of two independently operated check valves, two resilient wedge gate valves and bypass assembly. Working pressure shall be a minimum of 175 psi (1200 kPa). Flange dimension shall be in accordance with AWWA Class D. The entire assembly, including shutoff valves, shall be UL, FM, and ASSE approved.

B. Where hydraulic calculations require a reduction in system pressure loss to meet desired conditions, size of backflow preventer shall be increased as required to reduce system losses. Backflow preventer size shall not be less than the connected line size indicated.

C. Backflow preventer assembly shall be an AMES 4000 SS (Silver Bullet) or equivalent. Pressure losses shall not exceed the documented flow characteristics of the AMES 4000 SS.

D. Contractor shall verify code compliance of a double check assembly versus a reduced pressure principle backflow preventer. Should the local authority require a reduced pressure type, the reduced pressure assembly shall be as manufactured by AMES or equivalent.

E. Backflow preventer shall be installed by a certified plumbing contractor in accordance with the local plumbing authority.

PART 3 - EXECUTION

3.1 PIPING INSTALLATIONS

A. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. So far as practical, installation of piping shall leave adequate space for work of all other trades.

1. Deviations from approved "Working Plans" for sprinkler piping require written approval of the authority having jurisdiction. Written approval shall be on file with the Architect prior to deviating from the approved "Working Plans."

B. Install sprinkler piping to provide for system drainage in accordance with the most current edition of NFPA 13.

C. Use approved fittings to make all changes in direction, branch takeoffs from mains, and reductions in pipe sizes. Branch takeoffs to sprinkler heads shall occur from the top of sprinkler branch piping.

D. Install unions in pipes 2 inch (50 mm) and smaller, adjacent to each valve. Unions are not required on flanged devices or in piping installations using roll-grooved mechanical couplings.

E. Install flanges on valves, apparatus, and equipment having 2-1/2 inch (65 mm) and larger connections, unless ductile iron with grooved ends.

F. Hangers and Supports: In addition to the requirements specified in the Division-22 Section "Hangers and Supports for Plumbing Piping and Equipment," comply with the requirements of the most current editions of NFPA 13 and NFPA 14. Hanger and support spacing and locations for piping joined with roll-grooved mechanical couplings shall be in accordance with the roll-grooved mechanical coupling manufacturer's written instructions, for rigid systems. Provide protection from damage where subject to earthquake in accordance with the most current edition of NFPA 13.

G. Make connections between underground and above-ground piping using an approved transition piece strapped or fastened to prevent separation.

H. Provide mechanical sleeve seals at pipe penetrations in basement and foundation walls and penetration seals at openings in fire rated walls, floors and

ceilings. Refer to Division-22 Section "Piping Specialties for Plumbing Systems" for description and installation requirements.

I. Install test connections sized and located in accordance with the most current edition of NFPA 13 complete with shutoff valve. Test connections may also serve as drain pipes.

J. Install pressure gage on the riser or feed main at or near each test connection. Provide gage with a connection not less than 1/4 inch (6 mm) and having a soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and where they will not be subject to freezing.

K. Piping passing through areas exposed to freezing conditions shall be protected against freezing by insulated coverings, frostproof casings or other reliable means capable of maintaining a minimum temperature of 40°F (4°C). All sprinkler piping, heads, fittings, etc. shall be installed on "warm" side of insulation. Insulation shall be tight with no open joints. Piping shall not touch or be run immediately adjacent to building structural steel. Prior to installing piping in areas exposed to freezing, the contractor shall notify the architect or owner's representative.

3.2 PIPE JOINTS

A. Welded Joints: AWS B2.1, Level AR-3.

B. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows:

1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
2. Align threads at point of assembly.
3. Apply appropriate tape or thread compound to the external pipe threads.
4. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.
5. Damaged Threads: Do not use pipe with threads which are stripped, chipped, corroded, or otherwise damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

C. Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.

D. Mechanical Roll-Grooved Joints: Roll grooves on pipe ends dimensionally compatible with the couplings.

E. End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.

3.3 VALVE INSTALLATIONS

A. General: Install fire protection specialty valves, fittings, and specialties in accordance with the manufacturer's written instructions, the most current editions of NFPA 13 and 14, and the authority having jurisdiction.

B. Gate Valves: Install supervised-open gate valves so located to control all sources of water supply except fire department connections. Where there is more than one control valve, provide permanently marked identification signs indicating the portion of the system controlled by each valve. Refer to Division-22 Section "Identification for Plumbing Piping and Equipment" for valve tags and signs.

C. Install check valves in each water supply connection.

D. Alarm Check Valves: Install valves in the vertical position, or horizontal if allowed by manufacturer in proper direction of flow including the bypass check valve and retard chamber drain line connection. Install valve trim in accordance with the valve manufacturer's appropriate trim diagram. Test valve for proper operation.

E. Detector Check Valves: Install in proper direction of flow in a location to detect system leakage and unauthorized use of water, and to prevent backflow into public water mains. Install bypass meter, with gate valves on each side of the meter to permit meter removal, and check valve downstream from the meter.

F. Fire Department Valves: Install 2-1/2 inch (65 mm) fire department valves with quick-disconnect 2-1/2 to 1-1/2 inch (65 mm to 40 mm) reducing coupling and flow restriction device at each standpipe outlet for hose connections.

G. Siamese Installations:

1. Install automatic drip valves at the check valve on the fire department connection to the mains.
2. Install mechanical sleeve seal at pipe penetration in outside walls.

3.4 SPRINKLER HEAD INSTALLATIONS

A. In areas with acoustical tile ceilings, sprinkler heads shall be installed in the center of the ceiling grid.

B. Use manufacturer supplied tools to prevent damage during installations and as required to maintain UL/FM approval.

C. Sprinkler Heads: Fusible link type, and style as indicated or required by the application. Unless otherwise indicated, provide heads with nominal 1/2 inch (13 mm) discharge orifice, for "Ordinary" temperature range.

D. Provide high temperature sprinkler heads in equipment spaces where pressure and temperature relief valve(s) are to be installed.

E. Provide quick response sprinkler heads throughout the building.

F. Provide NFPA approved sprinkler head guards in all areas subject to potential damage. Sprinkler head guards shall be provided in the following areas and other similar type spaces subject to potential damage: multi-purpose rooms, activity rooms, mechanical rooms, electrical rooms, etc.

3.5 BACKFLOW PREVENTER

A. Install backflow preventer assemblies in accordance with UL, FM, and ASSE standards, as well as the local plumbing code and the local fire protection authority having jurisdiction.

3.6 FIELD QUALITY CONTROL

A. Flush, test, and inspect sprinkler piping systems in accordance with the most current edition of NFPA 13.

B. Flush, test, and inspect standpipe systems in accordance with the most current edition of NFPA 14.

C. Replace piping system components which do not pass the test procedures specified, and retest repaired portion of the system.

END OF SECTION 21 01 10

DIVISION 22 – PLUMBING

SECTION 22 01 00

BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

A. Unless otherwise modified, provisions of General Conditions, Supplementary Conditions and Division-01 govern work under the Plumbing Divisions.

B. Contract drawings for plumbing work are diagrammatic, intended to convey scope and general arrangement. All dimensions shall be verified prior to construction.

C. Refer questions involving document interpretation or discrepancies to Engineer for review and direction.

D. Correction of faulty work due to resolving discrepancies without authorization shall be the responsibility of the Contractor.

E. Should the Contractor discover any discrepancies or omissions on the drawings or in the specifications, he shall notify the Engineer of such conditions prior to the bid date. Otherwise, it will be understood that the drawings and specifications are clear as to what is intended and shall be as interpreted by the Engineer.

F. The complete set of Architectural, Structural, Civil, Mechanical, and Electrical drawings and specifications apply to this work.

1.2 SCOPE

A. The work in Division-22 includes furnishing and installing the plumbing systems complete and ready for satisfactory service.

B. Requirements specified govern work in all sections of Division-22.

1.3 REFERENCES

A. References to standards, codes, catalogs and recommendations are latest edition in effect on date of invitation to bid.

B. Refer to applicable contract drawings, specifications and addenda pertaining to other divisions for conditions affecting work.

C. Refer to Division-01 for description of alternates.

D. Refer to Division-01 for description of allowance items.

E. Refer to Division-01 for description of base bid items.

1.4 DEFINITIONS

A. Following are definitions of terms and expressions used in this Division:

1. "Approve" - to permit use of material, equipment or methods conditional upon compliance with contract document requirements.
2. "Concealed" - hidden from normal sight; includes work in crawl spaces, above ceilings, and in building shafts.
3. "Directed" - directed by Engineer.
4. "Equal, equivalent" - possessing the same performance qualities and characteristics and fulfilling the same utilitarian function.
5. "Exposed" - not concealed.
6. "Indicated" - indicated in Contract Documents.
7. "Piping" - includes pipe, fittings, valves, supports and accessories comprising a system.
8. "Provide" - furnish and install.
9. "Removable" - detachable from the structure or system without physical alteration of materials or equipment or disturbance to other construction.
10. "Review" - limited observation or checking to ascertain general conformance with design concepts and general compliance with contract document requirements. Such action does not constitute a waiver or alteration of the contract requirements. Verification of quantities and dimensions shall be the responsibility of the Contractor.
11. “Appurtenances” - a device or assembly installed in the referenced system which performs some useful referenced function in the operation, maintenance, servicing, economy or safety of the system. Some examples include, but are not limited to aerators, anchors, supports, gauges, backflow preventors, expansion tanks, filters, flow controls, heat exchangers, interceptors, meters, pressure reducing valves, relief valves, dampers, separators and similar devices.
12. “Record Documents” - drawings, plans and specifications that indicate the nature and location of work reported by Contractors, but not verified by Consultant. Record documents cannot be considered reliable; as they are based on information reported by the Contractor only and is not verified by the Architect or Engineer (A/E).

1.5 RIGGING REQUIREMENTS

A. Prior to bidding, the Contractor shall verify that all equipment can be physically rigged to the proposed location without disturbance or dismantling of any existing or new physical obstacles. Should the rigging of any new equipment appear to be an issue, the Contractor shall inform the Architect or Engineer (A/E) seven (7) days prior to the bid date that the rigging of the new equipment may present a problem. Otherwise, the Contractor shall, in accordance with the manufacturer’s approval and without voiding warranties and/or certifications, have the equipment “broken down” into sections as required to install the equipment in its proposed location without disturbance or dismantling of any existing or new physical obstacles.

B. Failure to inform the Architect or Engineer (A/E) seven (7) days prior to the bid of any rigging problems will result in the Contractor accepting full responsibility for all modifications to the equipment or the physical obstacles required to install the equipment in its proposed location without additional cost to the Owner.

1.6 CONTRACTOR'S INSTALLATION DRAWINGS

A. Prior to fabrication and installation, submit shop drawings (min. scale - 1/4" = 1' - 0") illustrating all plumbing piping, lighting fixtures, cable tray, conduit, expansion loops, supports, alignment guides and fire protection coordinated with each other and with the structure. Installation drawings shall be reviewed by Owner's representative prior to fabrication and installation of any new work and prior to the ordering of any plumbing equipment.

B. Failure to comply with Paragraph 1.6, A shall result in the following:

1. The Contractor shall accept full and absolute responsibility for the coordination of all project materials and equipment to be installed as indicated on the contract documents.
2. Proposed change orders and/or time extensions will not be accepted for any additional work that results from coordination related changes.
3. A credit shall be issued to the Owner for the value of the coordinated installation drawings; the value of the credit to the Owner shall be as determined by the A/E.

C. Computer (CADD) files of mechanical drawings (HVAC, plumbing, etc.) will be made available to the Contractor for use in the preparation of coordinated drawings, shop drawings or any other use.

1.7 MATERIAL, EQUIPMENT AND SUBSTITUTION REQUIREMENTS

A. Use products of one manufacturer where two or more items of same kind of equipment are required.

B. Materials and equipment shall have a record of two (2) years successful field use.

C. For certain items of equipment the specification is based upon the manufacturer's product. Other manufacturer’s names are listed. Contractor may purchase, conditional upon meeting project requirements, (i.e. space, structure and electrical requirements) equipment from the listed manufacturers.

D. Only manufacturer's equipment named on the drawings, upon which the specification is based, has been checked for this project. Contractor must check allocated space and structure for clearance suitability of equipment of alternate manufacturer including parts replacement and servicing.

E. Where the drawings and/or specifications indicate more than one allowable manufacturer for a particular piece of equipment and/or product, only those manufacturers indicated may submit products and services to be included in the work. Unless otherwise indicated, manufacturers other than those listed will not be acceptable.

F. Substitutions must be submitted for consideration seven (7) days prior to the original bid date. Consideration of substitutions shall be at the sole discretion of the Engineer. Substitution submittals shall include all information required in the "Submittals" paragraph of this specification section, as well as all other requirements indicated through the Division-22 specifications. Substitutions will not mitigate, in any way, the Contractor's responsibility in complying with the coordination, contract requirements or design intent. Any additional electrical, structural or special requirements, etc. shall be the responsibility of the Contractor. Also, any additional cost incurred as a result of substitution shall be the responsibility of the Contractor.

G. Nameplate: For each piece of power operated plumbing equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

H. Where items of equipment are indicated as Base Bid on the bid form include in the Bid price the cost of providing the equipment upon which the specification is based. In addition, submit with bid for Owner's consideration the amount to be added or deducted from the base bid for other listed manufacturers' equipment. Owner will advise Contractor within forty-five (45) days after award of contract of his selection.

1.8 MATERIAL AND EQUIPMENT LIST

A. Within thirty (30) days after award of the contract, submit for Engineer's review a list of subcontractors' and manufacturers' names for items proposed for this project.

1.9 SUBMITTALS

A. Where the drawings and/or specifications indicate more than one allowable manufacturer for a particular piece of equipment and/or product, only those manufacturers indicated may submit products and services to be included in the work. Unless otherwise indicated, manufacturers other than those listed will not be acceptable.

B. Submit shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review.

C. Shop Drawings: Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment. Include equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, drawings shall be

revised to show acceptable equipment and be resubmitted. All equipment and/or products shall be submitted by an authorized factory representative of that particular product.

D. Manufacturer's Data: Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.

E. Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), American Gas Association (AGA), American Refrigeration Institute (ARI), and Underwriters' Laboratories (UL), proof of such conformance shall be submitted to the Engineer for review. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable testing. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for review. The certificate shall identify the manufacturer, the product, and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the referenced standards listed.

F. Contractor shall thoroughly review and stamp all submittals to indicate compliance with contract requirements prior to submission and coordinate installation requirements for equipment submitted, including a) the verification of equipment weights relative to the existing and/or new structural support system and b) the verification of equipment dimensions relative to existing and/or new architectural conditions. Contractor shall be responsible for correctness of all submittals.

G. Compliance Review Form: Each equipment submittal must include a Compliance Review Form formatted as follows:

1. Section 1: Certify that the submittal is in complete compliance with the plans and specifications, except for the numbered and footnoted deviations and exceptions as defined herein. Deviations or exceptions taken in a cover letter or by contradiction or omission shall not constitute a release from the requirement that the equipment be in complete compliance with the plans and specifications.
2. Section 2: Provide a detailed paragraph by paragraph annotation of the specification with an individual “C”, “D”, or “E” noted in the margin, as follows:

    a. “C” shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
    b. “D” shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a

detailed explanation of how the intent of this specification is to be satisfied.

c. "E" shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

H. Electronic Submittals: Should the contractor elect to submit electronic shop drawings/submittals, the procedure shall be as follows:

1. Provide a transmittal with the electronic shop drawing/submittal indicating that the document was transmitted electronically. Transmittal shall also include verification of the contractor's review indicating compliance with the contract documents in accordance with paragraph 1.9.F of this section.
2. Sequentially number all pages on the electronic shop drawing/submittal. The total number of pages shall be reflected in the transmittal.
3. Submittal review comments shall be transmitted electronically. Large documents will be scanned with comments as necessary and returned electronically.
4. All shop drawings such as, but not limited to: coordination drawings, ductwork shop drawings, fire alarm drawings, ductbank layouts, etc. shall be submitted in hard copy, full size format.
5. Provide hard copy of the shop drawing/submittal for each of the Operations and Maintenance Manuals.
6. Failure to comply with the above will result in the submittal being returned and marked "Not Reviewed".

I. Submittals will be reviewed for general compliance with design concept in accordance with contract documents. Dimensions, quantities, weights, or other details will not be verified by the A/E; this is the responsibility of the Contractor.

J. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted.

K. Review Period: BKM shall be allotted two (2) weeks for the processing, review and return of all submittals. It shall be incumbent upon the Contractor to include this time period in their schedule.

1. Resubmittals: BKM shall be allotted an additional two weeks (14 days) for the review of each resubmittal. Again, it shall be the Contractor's responsibility to submit the appropriate materials in a timely fashion.
2. Contract Extension: No extension in contract time will be authorized as a result of the timeline addressed above.

L. Submittal Identifications:

1. Place a permanent label or title block on each submittal for identification.
2. Indicate name of firm or entity that prepared each submittal on label or title block.
3. Provide a space approximately 4 by 5 inches on label or beside title block to record contractor's review and approval markings and action taken by A/E.
4. Include the following information on label for processing and recording action taken:

a. Project name
b. Date
c. Name and address of A/E
d. Name and address of contractor
e. Name and address of subcontractor
f. Name and address of supplier
g. Name of manufacturer
h. Unique identifier, including revision number
i. Number and title of appropriate specification section
j. Drawing number and detail references, as appropriate
k. Other necessary identification
l. Example: 220700-01-0

- 220700 references the spec section
- 01 indicates this is the first submittal from this spec section
- 0 indicates this is the original submittal (where 1 would indicate this is the first re-submittal)

M. The engineer will provide a maximum of two (2) submittal reviews per equipment submittal; the initial review plus one (1) re-submittal. Should the re-submittal be returned “Not Acceptable” or “Revise and Resubmit”, the contractor shall provide the exact manufacturer and model indicated in the contract documents as the basis of design. In addition, the contractor shall accept complete responsibility for all delays resulting from the submittal review process extending beyond two (2) reviews per equipment submittal.

N. Resubmittals: Resubmittals shall comply with paragraph 1.09 of this section and the following additional requirements.

1. Resubmittals shall include a written response to each submittal comment. Provide a detailed comment by comment annotation of the submittal review comments with an individual “C”, “D”, or “E” as follows:

a. “C” shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
b. “D” shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.
c. “E” shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

1.10 MANUFACTURER'S RECOMMENDATIONS

A. Installation procedures are required to be in accordance with the recommendations of the manufacturer of the material being installed.

1.11 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

1.12 SAFETY REQUIREMENTS

A. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded in accordance with OSHA. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified herein. Items such as catwalks, ladders, and guardrails shall be provided where required for safe operation and maintenance of equipment.

1.13 WORKMANSHIP

A. Remove and replace, at no extra cost, all work not orderly, reasonably neat, or workmanlike.

B. Coordinate all work and cooperate with other trades to facilitate execution of work.

1.14 REGULATIONS AND PERMITS

A. Comply with all applicable codes and regulations.

B. All equipment provided shall be in accordance with all applicable local, state, and federal codes, guidelines and standards, as well as the authority having jurisdiction. Equipment and installation shall be in compliance with all applicable energy codes including the most current version of ASHRAE Standard 90.1.

C. Obtain and pay for all required permits.

1.15 UTILITY CONNECTIONS

A. Area connection charges for water and sewers will be paid by the Owner.

B. Application for water meter will be made by the Owner.

C. Contractor shall include an allowance as identified in Division-01 for providing water meter, vault, and connection to main by Bureau of Water Supply.

D. Gas Service: Arrange for installation of gas meter and connection to main by gas utility. Pay charges, if required. Gas main extension charges, if any, will be paid by the Owner.

1. All gas installations on and at the Owner's property/building must conform to BGE’s construction and installation requirements. Gas meter installation requirements shall include, but not be limited to, the following:

a. Meters shall not be installed within three feet (900 mm) of any equipment with an open flame or subject to electric arcing.
b. Meters shall not be installed in areas where the clearance from the front of the meter to an opposite wall is less than two feet (600 mm).
c. Gas meters shall be installed such that there are four feet (1200 mm) of clearance from the front of the meter to a wall directly opposite where an electric meter is located.
d. Outside meters shall not be installed within three feet (900 mm) of an opening used for ventilation.
e. Meters shall not be installed in unventilated spaces.
f. Meters shall not be installed in places where they may be subject to damage (driveways, sidewalks, etc.) unless suitable traffic protection is provided.
g. Contractor shall provide a concrete pad for installation of the gas meter. Pad requirements shall be as required by the gas utility company.

2. Gas conduit installation requirements shall be as follows:

a. The following gas conduit specification is acceptable for use on BGE system: UL Schedule 40 DB 60.
b. Conduit for gas services (not mains) is required whenever installed in common with electric ducts.
c. Gas conduit shall not exceed one 45-degree (.785 Radians) bend, and must be terminated a minimum of five feet (1500 mm) from all buildings/structures. No 90-degree (1.57 Radians) bends are permitted.
d. Only one gas service per conduit is permitted.
e. Gas conduits will be concrete-encased.
f. Installation of gas piping into electrical conduit bank is prohibited.
g. PVC conduit (minimum 4") (minimum 100 mm), solid wall, not split) may be used as a sleeve installed in advance of paving to facilitate future installation of small size (2" and smaller) (50 mm and smaller) gas services where casing is not required. The ends of the sleeve should not be sealed after insertion of the carrier pipe to avoid containment of gas in case of a gas leak. However, the end of the sleeve on a service line nearest the building should be sealed after installation of the carrier pipe and the opposite end of the sleeve left open.
h. Lengths of continuous runs for gas ducts shall not exceed 450 feet (135 m).
i. Mechanical joints on gas services are not allowed inside of conduit. Open trench space provision must be made to allow BGE room to make these connections.
j. Marker tape is required, and must be 12" (300 mm) minimum above all gas conduits.
k. Required minimum depth of conduits from final grade to top of conduit is 24" (600 mm).
l. Required vertical separation for gas conduit crossing foreign structures is 12" (300 mm).
m. Horizontal separation between gas conduit and electric conduit, in common trench, should be 12" (300 mm) minimum.

1.16 CUTTING AND PATCHING

A. Unless otherwise directed, do all cutting and patching. Damaged work, including fireproofing and waterproofing shall be repaired by skilled mechanics of the trade involved.

B. Do not cut walls, floors, roofs, reinforced concrete or structural steel without structural Engineer's permission. Install services without affecting reinforcing steel.

C. In precast concrete plank drill all holes with a Carboloy tipped drill. Follow instructions of structural Engineer. Cut no reinforcing bars.

1.17 LINTELS

A. Under this Section provide all lintels not provided elsewhere which are required for openings for the installations of mechanical and plumbing work. Lintels shall meet the requirements of the structural sections.

1.18 CLEANING UP

A. Keep premises free from accumulation of debris.

B. Remove tools, scaffolding, surplus material, debris, and leave premises broom clean.

C. On discontinuance of part of the work, place all debris in containers and promptly remove them from the Owner's property.

D. Leave all areas broom clean.

E. Final clean-up shall be performed.

1.19 AREAS REQUIRING SPECIAL FINISHES/PAINTING

A. Refer to the Architectural division for painting requirements including all exposed and uninsulated piping including valves, traps, strainers and appurtenant items; and exposed electrical work including conduit, boxes, switches starters and disconnects in kitchens, cafeterias, dining rooms, serving pantries and utility rooms. Finish shall not be applied to nameplates, pushbuttons. Stainless steel housing and plates require no plating or paints.

B. Provide surface preparation, priming and painting of all mechanical room floors to provide a smooth, cleanable surface. Primer and paint shall be appropriate for concrete slab surfaces. Where painting over existing surfaces or coatings, follow manufacturer's recommendations for surface preparation, priming and painting. Architectural section "Painting" shall govern the painting installation. Color shall be selected by Architect.

1.20 PROTECTION

A. Protect mechanical and electrical material and equipment from the elements or other injury as soon as delivered on premises. Protect fixtures as soon as they are set. Board over water closets and post notices prohibiting their use.

B. Cap or plug openings in equipment, piping and conduit systems to exclude dirt and other foreign material. Rags, wool, cotton, paper, waste or similar materials shall not be used for plugging.

C. Contractor shall protect all existing mechanical, electrical and architectural equipment, materials, finishes, etc. located within or adjacent to the work environment. Contractor shall be responsible for restoration of all existing mechanical, electrical and architectural items to remain. All equipment to remain must be restored to its pre-existing condition prior to the start of work. Restoration and/or replacement shall be at no cost to the Owner.

D. Contractor shall provide temporary cooling and heating as required to protect all construction materials from the potential adverse effects of high or low temperature and humidity. Upon delivery of ceiling and other finish materials to a location within the building, environmental conditions in all spaces where the materials will be either stored or installed shall be permanently maintained at 75˚F (±2˚F) and 50% RH (±5%). Should the HVAC include a reheat system, the reheat system shall be energized to provide temperature and humidity control whenever the HVAC system is energized. Contractor shall pay for all utility, fuel, operational, maintenance and repair costs associated with providing the environmental conditions indicated above until the owner accepts occupancy of the building.

1.21 PIPE TESTING

A. Prior to the balancing of systems, the mechanical contractor shall air and/or hydrostatically test the following systems in accordance with the latest ASME B31 (ASME Code for Pressure Piping) and NFPA requirements.

1. Air Test:

a. Gas

2. Hydrostatic Test:

a. Domestic Water

B. Pressure tests shall also be performed prior to the installation of all insulation materials.

C. Hydrostatic Test: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed, wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.

1. Required test period is four (4) hours.

2. Hydrostatically test each piping system at 150% of operating pressure indicated, but not less than 100 psi (690 kPa) test pressure.
3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds less than one percent (1.0%) of test pressure.
4. Upon completion of roughing-in and before setting fixtures, the entire new domestic water system shall be tested. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately in a manner described for the entire system.
5. Prior to testing, verify the pressures listed above are in accordance with the latest ASME B31 code and NFPA. Should a discrepancy exist between the ASME B31 code, NFPA, and/or the pressures indicated above, contact the Engineer prior to testing.

D. Air Test:

1. Gas piping shall be air tested at 200 psi (1380 kPa).
2. Prior to testing, verify the pressures listed above are in accordance with the latest ASME B31 code and NFPA. Should a discrepancy exist between the ASME B31 code, NFPA, and/or the pressures indicated above, contact the Engineer prior to testing.

E. Sanitary and Storm Water Piping Systems:

1. All soil, waste, vent and storm water piping shall be tested by the Contractor and reviewed by the Architect before acceptance. All piping located underground shall be tested before backfilling. The costs of all equipment required for tests are to be included under the contract price.
2. The entire new drainage system and venting system shall have all necessary openings plugged and filled with water to the level of the highest vent stack above the roof. The system shall hold this water for four (4) hours without showing a drop in water level. Where a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system, except a vertical stack 10 feet (3000 mm) above the highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure, or a pump may be used to supply the required pressure.

F. Drain test water from piping systems after testing and repair work has been completed.

G. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

1.22 CLEANING OF SYSTEMS

A. After satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers and other accessory items, thoroughly clean all systems. Blow out and flush piping until interiors are free of foreign matter.

B. Flush piping in recirculating water systems to remove all cutting oil, excess pipe joint compound and other foreign materials. Furnish necessary temporary pumping equipment to thoroughly clean the water piping. Do not use any system pump until after cleaning and flushing has been accomplished to the satisfaction of the Engineer. Employ chemical cleaners, including a non-foaming detergent, not harmful to system components. After cleaning operation, final flushing and refilling the residual alkalinity shall not exceed 300 parts per million. Work shall be performed or supervised by a qualified water treatment service company with personnel skilled in the safe and proper use of chemicals and in testing procedures. After completion, submit a certificate of completion to Engineer stating name of the service company used.

C. Leave strainers and dirt pockets in clean condition.

D. Should any system become clogged with construction refuse after acceptance, the contractor shall pay for all labor and materials required to locate and remove the obstruction and replace and repair work disturbed.

E. Thoroughly clean plumbing fixture using non-scratching cleaners. Polish chromium plated work.

F. Leave all systems clean, and in complete running order.

G. Disinfect potable water systems as prescribed by local code. Take precautions to avoid use of fixtures during disinfection period.

H. Equipment that has been subjected to the elements shall be cleaned of all rust, dirt and debris and repainted to match original finish.

1.23 OPERATING AND MAINTENANCE MANUAL

A. Submit Operation and Maintenance Manuals in compliance with Section 017823, other applicable sections and the requirements of this paragraph.

B. At a minimum, the manual shall contain the following:

1. Title page
2. Table of contents
3. Contractor and sub-contractor contact information
4. Supplier contact information for all plumbing equipment
5. Copies of manufacturer’s and contractor’s warranty information (project and equipment) for all plumbing equipment.
6. Submittal log for all plumbing equipment
7. One (1) reviewed copy of each shop drawing or submittal incorporating all A/E and owner submittal review comments.
8. Copy of inspector acceptance certificates / documents.
9. Provide an 11 x 17 fold-out drawing of each floor plan and indicate locations of system shutoff valves.
10. All pipe and equipment pressure test reports complete with 11 x 17 fold-out drawing, indicating all systems tested.
11. Maintenance procedures for each item of plumbing equipment to include frequency and type of maintenance, spare parts and attic/stock list. This shall include the manufacturer’s literature indicating operating and maintenance instructions, parts list, illustrations and diagrams.

12. Valve tag chart
13. Commissioning, system verification and functional performance test results.

1.24 TOOLS AND LUBRICANTS

A. Furnish and turn over to the Owner, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Owner.

D. Lubricants: A minimum of one quart (.9 L) of oil, and one pound (450 g) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

1.25 FIELD INSTRUCTION

A. Upon completion of work, instruct Owner's representative in the proper operation and maintenance of the plumbing and electrical systems in accordance with section 017900 Demonstration and Testing, and the requirements of this section.

B. Instruction periods specified below shall be in addition to instruction specified for certain items elsewhere in the specifications.

C. Instructions shall be given by persons expert in the operation and maintenance and shall be for a period of not less than two (2) eight hour days.

1.26 RECORD DOCUMENTS

A. The Contractor shall maintain a record set of plumbing prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.

B. A separate set of neat, legible mechanical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner’s Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections

C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in electronic CADD format. One (1) set of full size prints, one (1) CD of the electronic CADD drawings (in AutoCad and pdf format), along with the red-lined marked up field set shall be delivered to the owner upon completion. If requested, the electronic CADD documents shall be up-loaded to the owner's FTP site. The final CADD documents shall indicate in the title or revision block "RECORD DOCUMENTS" along with the date completed. The electronic format shall be compatible with the owner's preferred version of AutoCad. Coordinate with the owner before producing the CD or up-loading to the FTP site.

D. Computer (CADD) files of plumbing drawings will be made available to the Contractor upon receipt of a signed waiver (available upon request). One CD will be made available to the general contractor or construction manager for distribution to the trades.

E. Should the Contractor's electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

1.27 OUTAGES

A. Unless otherwise specified, outages of any services required for the performance of this contract and affecting areas other than the immediate work area shall be scheduled at least ten (10) days in advance with the Owner's Representative. All such outages shall be performed during other than normal duty hours.

B. The Contractor shall include in his price the cost of all premium time required for outages and other work which interferes with the normal use of the building, which will be performed, in most cases, during other than normal work time and the convenience of the using agency.

1.28 LEAD FREE COMPLIANCE

A. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be "lead-free" in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

1.29 LEED CERTIFICATION

A. This project is required to obtain a LEED certification. The Contractor shall provide all required LEED documentation as required to achieve the construction related LEED credits.

B. The project includes both LEED Fundamental and Enhanced Commissioning. Provide all services as required for compliance with the Fundamental and Enhanced Commissioning requirements. Coordinate with the Commissioning Agent as required. Refer to the Commissioning specification sections for additional information.

1.30 GUARANTEE/WARRANTY

A. Each Contractor shall furnish a guarantee covering all labor and materials furnished by him for a period of two (2) years from the date of final acceptance of his work, and he shall agree to repair and make good at his own expense any and all defects which may appear in his work during that time if, in the judgment of the Engineer, such defects arise from defective workmanship and/or imperfect or inferior material.

B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of guarantee shall be delivered to the Owner.

C. Within the two (2) year warranty/guarantee period, manufacturer’s recommended maintenance shall be provided by the Contractor.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

Not Applicable

END OF SECTION 22 01 00

SECTION 22 02 00

PROJECT CLOSEOUT - PLUMBING

PART 1 – GENERAL

1.1 SUMMARY

A. This section provides a summary of the primary mechanical project closeout activities, however, this section does not attempt to address all project closeout requirements. Closeout activities referenced in this section include the following:

1. Pressure Testing
2. Start-up
3. Punch-out Procedures
4. Testing, Adjusting and Balancing
5. Commissioning and System Verification
6. Operation and Maintenance Manuals (O & M Manuals)
7. Demonstration and Training
8. Record Documents
9. Close-out Documents

B. This Section shall not supersede any other close-out section or requirements of the Contract. Refer to other Divisions of the specifications and the General Requirements of the Contract for further instructions.

PART 2 – PRODUCTS

Not Applicable

PART 3 – EXECUTION

3.1 PRESSURE TESTING

A. Piping: The Contractor shall perform pressure testing on all piping systems.

B. Final pressure test results shall be submitted as a separate project submittal for review and included with the Test and Balance Report. Upon review for general conformance, include all pressure tests in the O & M Manual.

C. All factory performed equipment test results shall be included in the final O & M Manuals.

D. Where re-tests were required, indicate remedial action taken and submit in test report.

3.2 START-UP

A. The Contractor shall perform start-up on each piece of mechanical equipment as specified in each section of Division-22.

B. Where indicated in each section of Division-22, the services of a factory authorized and certified technician shall be required to perform the equipment start-up. Start-up by any other organization other than as required by the manufacturer is unacceptable.

C. Start-up reports shall be provided for all equipment and be included in the final O & M Manuals.

3.3 PUNCH-OUT PROCEDURES

A. Preliminary Punch-out:

1. Prior to requesting an inspection from the Owner, Engineer, or Permit Official, the General Contractor or Construction Manager (GC or CM) shall provide a preliminary punch-out of the area in question.
2. Once completed, their punch list shall be supplied to each trade for corrections and completion. The punch list shall also be provided to the Engineer for their use.
3. Upon being informed that the trade contractors have addressed all of the outstanding items, the GC / CM shall backcheck the work and update the punch list.

B. Final Punch-out:

1. Final punch-out by the engineer shall not commence until the GC or CM has exhausted their review and has signed off on all items.
2. A copy of the sign-off shall be provided to the Engineer for their record.
3. Once the above has been completed, the Engineer shall be notified that the work is substantially complete and ready for a final punch-out.
4. Depending on the size, schedule, and project complexity, punch-outs may be requested for specific areas or systems, rather than the facility as a whole. Examples of specific requests include the following:

    a. Above ceiling
    b. Mock-ups for any repetitive installation to confirm acceptance prior to continuing (labs, dorms, offices, etc.)
    c. Equipment rooms

3.4 TESTING, ADJUSTING AND BALANCING

A. Comply with all provisions of Division-23 Section, “Testing, Adjusting and Balancing” (TAB) for the systems listed, but not limited to, the following:

1. Domestic hot water recirc pump and associated balance valves

B. TAB reports shall be submitted as a separate project submittal for review. Upon review for general conformance, include the final TAB report in the O & M manual.

3.5 COMMISSIONING AND SYSTEMS VERIFICATION

A. The Contractor shall perform commissioning and system verification tests to verify that all mechanical systems are functionally performing in accordance with the Contract Documents.

B. Comply with all applicable sections of Division-1 and Division-22 to include, but not be limited to, “Basic Plumbing Requirements” and “Commissioning”, where applicable.

C. Prepare a check list and submit for review a list of all system verification and functional performance tests to be performed for each mechanical system.

D. Any system or component failure shall be repaired or replaced and re-tested until test is successfully completed.

E. Upon satisfactory completion of the commissioning and system verification, all test reports shall be submitted for review. Final report shall be included in the O & M Manuals.

3.6 OPERATION AND MAINTENANCE MANUALS

A. Provide in accordance with Division 1and Section 230100.

B. The O & M Manuals shall be submitted to the A/E for review of general conformance.

3.7 DEMONSTRATION AND TRAINING

A. Provide in accordance with Section 017900, and Section 230100.

3.8 RECORD DOCUMENTS

A. Provide in accordance with Section 017839, Project, Records Documents, and Section 230100. CLOSEOUT DOCUMENTS

B. Prior to Substantial Completion and /or Final Payment, the Contractor shall prepare and submit the following:

1. Final punch lists indicating completion of all items
2. All record drawings
3. All record specifications
4. Operation and Maintenance Manuals
5. Complete final cleaning
6. Remove temporary facilities and complete site restoration

END OF SECTION 22 02 00

SECTION 22 05 00

BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this Section.

B. Requirements specified in all Division-22 sections apply to this Section.

1.2 SUMMARY

A. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:

1. Mechanical equipment nameplate data.
2. Firestopping: Provide seals for all openings through fire-rated walls, floors, or ceilings used as passage for mechanical and electrical components such as piping, conduit, etc.
3. Excavation for underground utilities and services, including underground piping (under the building and from building to utility connection), tanks, basins, and equipment up to five (5) feet (1500 mm) outside the building.
4. Miscellaneous metals for support of mechanical materials and equipment.
5. Wood grounds, nailers, blocking, fasteners, and anchorage for support of mechanical materials and equipment.
6. Joint sealers for sealing around mechanical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.
7. Access panels and doors in walls, ceilings, and floors for access to mechanical materials and equipment.

1.3 DEFINITIONS

A. The following definitions apply to excavation operations:

1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
2. Subbase: As used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.
3. Subgrade: As used in this Section refers to the compacted soil immediately below the slab or pavement system.

4. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect.

B. The following definitions apply to firestopping:

1. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.
2. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.
3. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gases and smoke.
4. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.
5. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.
6. System: Specific products and applications classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.
7. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division-01 Specification Sections.

B. Product data for the following products:

1. Access panels and doors
2. Joint sealers

C. Firestopping: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures.

1. Provide details of each proposed assembly identifying intended products and applicable UL system number, or UL classified devices.
2. Provide drawings relating to non-standard applications as needed.

D. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for mechanical materials and equipment.

E. Coordination drawings for access panel and door locations in accordance with Division-22 sections.

F. Samples of joint sealer, consisting of strips of actual products showing full range of colors available for each product.

G. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this Section.

H. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.

1. Coordinate sequencing with construction phasing and Owner occupancy specified in Division-01 Section "Summary of Work."

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer for the installation and application of joint sealers, access panels and doors, and firestopping materials with at least two years' experience with installations.

B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

C. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

1. Provide UL Label on each fire-rated access door.

D. Local and State Regulatory Requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL firestop system numbers, or UL classified devices.

E. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61- G).

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

1.7 PROJECT CONDITIONS

A. Conditions Affecting Excavations: The following project conditions apply:

1. Maintain and protect existing building services which transit the area affected by selective demolition.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
3. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.
4. Uncharted or Incorrectly Charted Utilities: Contact utility owner immediately for instructions.
5. Provide temporary utility services to affected areas. Provide minimum of 48-hour notice to Architect prior to utility interruption.
6. Use of explosives is not permitted.

C. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

1.8 SEQUENCE AND SCHEDULING

A. Coordinate the shut-off and disconnection of utility services with the Owner and the utility company.

B. Notify the Architect at least five (5) days prior to commencing demolition operations.

C. Perform demolition in phases as indicated.

PART 2 - PRODUCTS

2.1 MECHANICAL EQUIPMENT NAMEPLATE DATA

A. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.2 FIRESTOPPING

A. All penetrations through fire barriers shall be firestopped in accordance with Section 078413 Penetration Firestopping.

2.3 SMOKE STOPPING

A. All penetrations through smoke barriers, smoke partitions, or any other surface required to resist the passage of smoke shall be provided in accordance with Section 078443, Joint Firestopping.

2.4 SOIL MATERIALS

A. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.

B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch (40 mm) sieve, and not more than 5 percent passing a No. 4 sieve.

C. Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock, or gravel larger than 2 inches (150 mm) in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

2.5 MISCELLANEOUS METALS

A. Steel plates, shapes, bars, and bar grating: ASTM A 36.

B. Cold-Formed Steel Tubing: ASTM A 500.

C. Hot-Rolled Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Schedule 40, welded.

E. Non-shrink, Non-metallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout, recommended for interior and exterior applications.

F. Fasteners: Zinc-coated, type, grade, and class as required.

2.6 MISCELLANEOUS LUMBER

A. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPA rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.

B. Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 15/32 inches (12 mm).

2.7 JOINT SEALERS

A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.

B. Colors: As selected by the Architect from manufacturer's standard colors.

C. Elastomeric Joint Sealers: Provide the following types:

1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with non-porous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.

D. Acrylic-Emulsion Sealants: One-part, non-sag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.

E. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes through fire rated walls and floors. Sealants and accessories shall have fire resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

2.8 ACCESS DOORS

A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

B. Frames: 16-gage (1.6 mm) steel, with a 1-inch (25 mm) wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.

1. For Installation in Masonry, Concrete, Ceramic Tile, or Wood Paneling: 1-inch (25 mm) wide exposed perimeter flange and adjustable metal masonry anchors.
2. For Gypsum Wallboard or Plaster: Perforated flanges with wallboard bead.
3. For Full-Bed Plaster Applications: Galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

C. Flush Panel Doors: 14-gage (2 mm) sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees (3.05 Radians); factory-applied prime paint.

1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

D. Locking Devices: Where indicated, provide 5-pin or 5-disc type cylinder locks, individually keyed; provide two (2) keys.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FIRESTOP INSTALLATION

A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction and the requirements of Sections 078413 and 078443.

3.3 PREPARATION FOR JOINT SEALERS

A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.

B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

3.4 EXCAVATION

A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.

B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.

1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches (750 mm) below finished grade elevation.

C. Install sediment and erosion control measures in accordance with local codes and ordinances.

D. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

E. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.

F. Excavation for Underground Tanks, Basins, and Mechanical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot (30 mm); plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

1. Excavate by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch (25 mm) in diameter and larger with emulsified asphalt tree pain.
2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

G. Trenching: Excavate trenches for mechanical installations as follows:

1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches (150 to 225 mm) clearance on both sides of pipe and equipment.
2. Excavate trenches to depth indicated or required for piping to establish indicated slope and invert elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.
3. Limit the length of open trench to that in which pipe can be installed, tested, and the trench backfilled within the same day.
4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of pipe. Provide a minimum of 6 inches (150 mm) of stone or gravel cushion between rock bearing surface and pipe.
5. Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment on undisturbed soil.
6. For pipes or equipment 6 inches (150 mm) or larger in nominal size, shape bottom of trench to fit bottom 1/4 of the circumference. Fill unevenness with tamped sand backfill. At each pipe joint over-excavate to relieve the bell or pipe joint of the pipe of loads, and to ensure continuous bearing of the pipe barrel on the bearing surface.

H. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F (2 degrees C).

I. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.

1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
2. Under building slabs, use drainage fill materials.
3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
4. For piping less than 30 inches (750 mm) below surface of roadways, provide 4-inch (100 mm) thick concrete base slab support. After installation and testing of piping, provide a 4-inch (100 mm) thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
5. In other areas, use excavated or borrowed materials.

J. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Inspection, testing, approval, and locations of underground utilities have been recorded.
2. Removal of concrete formwork.
3. Removal of shoring and bracing, and backfilling of voids.
4. Removal of trash and debris.

K. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches (200 mm) in loose depth for material compacted by heavy equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

L. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

M. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them approximately to same elevation in each lift.

N. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.

1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
2. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches (300 mm) of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.

3. Areas Under Walkways: Compact top 6 inches (150 mm) of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
4. Other Areas: Compact top 6 inches (150 mm) of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
5. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.

O. Subsidence: Where subsidence occurs at mechanical installation excavations during the period twelve (12) months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 APPLICATION OF JOINT SEALERS

A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
2. Comply with recommendations of ASTM C 790 for use of acrylic - emulsion joint sealants.

B. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and

to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.9 INSTALLATION OF ACCESS DOORS

A. Provide access doors (minimum 18" x 18") as required to provide maintainable access to all mechanical equipment including, but not limited to, valves, etc.

B. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

C. Adjust hardware and panels after installation for proper operation.

END OF SECTION 22 05 00

SECTION 22 05 13

ELECTRICAL PROVISIONS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of electrical provisions to be provided for mechanical work is indicated in other Division-22 sections, on drawings, and as further specified in this section.

B. Types of work normally recognized as electrical, but provided as mechanical, specified or partially specified in this section, include but are not necessarily limited to the following:

1. Motors for mechanical equipment.
2. Starters for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical-electrical devices provided for mechanical systems, to equipment control panels.

C. Refer to Division-23 Controls sections for control system wiring.

D. Refer to other Division-22 sections for specific individual mechanical equipment electrical requirements.

E. Refer to Division-26 sections for motor starters and controls not furnished integrally with mechanical equipment.

F. Refer to Division-26 sections for junction boxes and disconnect switches required for motors and other electrical units of mechanical equipment.

1.2 QUALITY ASSURANCE

A. Coordination with Electrical Work: Wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in Division-26 sections for electrical work of this section which is not otherwise specified.

B. Standards: For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology herein. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.3 SUBMITTALS

A. Listing, Motors of Mechanical Work: Concurrently, with submittal of mechanical products listing (Basic Mechanical and Division-1 requirements), submit separate listing showing rating, power characteristics, application (connected equipment), and general location of every motor to be provided with mechanical work. Submit updated information promptly when and if initial data is revised.

1. Include in listing of motors, notations of whether motor starter is furnished or installed integrally with motor or equipment containing motor.

PART 2 - PRODUCTS

2.1 MOTORS

A. Motor Characteristics: Except where more stringent requirements are indicated, and except where required item of mechanical equipment cannot be obtained with fully complying motor, comply with the following requirements for motors of mechanical work:

B. Temperature Rating: Rated for 113 degrees F (40 degrees C) environment with maximum 122 degrees F (50 degrees C) temperature rise for continuous duty at full-load (Class B Insulation).

C. Starting Capability: Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than five (5) starts per hour for manually controlled motors.

D. Phases and Current Characteristics: Provide squirrel cage induction polyphase motors for 1/2 hp (.4 kW) and larger, and provide capacitor-start single-phase motors for 1/3 hp (.25 kW) and smaller, except 1/6 hp (.1 kW) and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division-26 sections, and with individual equipment requirements specified in other Division-22 requirements. For 2-speed motors provide two (2) separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

E. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.

F. Motor Construction: Provide general purpose, continuous duty motors, Class F insulation, Design "B" except "C" where required for high starting torque.

1. Bearings: Ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is normally inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual sections of Division-22 for fractional-hp light-duty motors where sleeve-type bearings are permitted.

2. Enclosure Type: Except as otherwise indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division-22 for other enclosure requirements.
3. Overload Protection: Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
4. Noise Rating: Provide industry standard "Quiet" rating on motors.
5. Efficiency: For motors 1 horsepower (.7 kW) or higher, provide motors with minimum efficiencies as follows in accordance with IEEE Standard 112, test method B:

a. Open Motors (ODP)

MOTOR HP (KW)		MINIMUM EFFICIENCY *		
		1200 RPM	1800 RPM	3600 RPM
1	(.7)	82.5%	85.5%	77.0%
1.5	(1.1)	86.5%	86.5%	84.0%
2	(1.5)	87.5%	86.5%	85.5%
3	(2.2)	88.5%	89.5%	85.5%
5	(4)	89.5%	89.5%	86.5%
7.5	(5.6)	90.2%	91.0%	88.5%
10	(8)	91.7%	91.7%	89.5%

* Required Full Load Nominal Efficiency shall be in accordance with EISA 2007. Where efficiency listed above is higher than the EISA 2007 requirement, provide the higher efficiency indicated.

b. Enclosed Motors (TEFC)

MOTOR HP (KW)		MINIMUM EFFICIENCY *		
		1200 RPM	1800 RPM	3600 RPM
1	(.7)	82.5%	85.5%	77.0%
1.5	(1.1)	87.5%	86.5%	84.0%
2	(1.5)	88.5%	86.5%	85.5%
3	(2.2)	89.5%	89.5%	86.5%
5	(4)	89.5%	89.5%	88.5%
7.5	(5.6)	91.0%	91.7%	89.5%
10	(8)	91.0%	91.7%	90.2%

* Required Full Load Nominal Efficiency shall be in accordance with EISA 2007. Where efficiency listed above is higher than the EISA 2007 requirement, provide the higher efficiency indicated.

c. Where fan or pump motors are used in conjunction with, or controlled by, a variable frequency drive (VFD), motors shall be suitable for VFD operation (inverter duty motors).

d. For motors less than 1 horsepower (.7 kW), provide motors with higher efficiency than "average standard industry motors," in accordance with IEEE Standard 112, test method B.

G. Nameplate: Provide metal nameplate on each motor, indicating full identification of manufacturer, ratings, characteristics, construction, special feature and similar information.

H. Motor Modifications: In cases where the equipment submitted requires additional motors and/or controls, circuiting and related equipment shall be provided as approved and in accordance with the National Electrical Code. All costs relative to these electrical changes shall be included under the Section in which the equipment is furnished and installed and shall be coordinated with the electrical work at no expense to the Owner.

I. Power Factor: All motors one (1) horsepower and above shall have a minimum power factor of 0.90.

J. All motors operated on variable frequency drives shall be equipped with a maintenance free, conductive microfiber, shaft grounding ring with a minimum of two (2) rows of circumferential microfibers to discharge electrical shaft currents within the motor and/or its bearings. Motors up to 100 HP shall be provided with a minimum of one (1) shaft grounding ring installed either on the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor pump manufacturer or contractor and shall be installed in accordance with the manufacturer’s recommendations.

2.2 MECHANICAL EQUIPMENT

A. All mechanical equipment shall be approved and listed by Underwriters' Laboratories (UL) and shall bear nameplate indicating same.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 hp (.25 kW) and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Deliver starters and wiring devices which have not been factory installed on equipment unit to electrical Installer for installation.

C. Install furnished under Division-26 starter panels and wiring devices at locations indicated, securely supported and anchored, and in accordance with manufacturer's installation instructions. Locate in accordance with National Electric Code for installation requirements.

END OF SECTION 22 05 13

SECTION 22 05 14

PIPE, TUBE AND FITTINGS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in other Division-22 sections.

B. Types of pipes and pipe fittings specified in this section include the following:

1. Steel Pipes
2. Copper Tube
3. Cast-Iron Pressure Pipes
4. Cast-Iron Soil Pipes
5. Plastic Pipes
6. Grooved Piping Products
7. Miscellaneous Piping Materials/Products

C. Pipes and pipe fittings furnished as part of factory-fabricated equipment are specified as part of the equipment assembly in other Division-22 sections.

D. Refer to all Division-21 and -22 sections.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.

   a. Certify welding of piping work using the Standard Procedure Specifications by, and welders tested under supervision of, National Certified Pipe Welding Bureau (NCPWB).

2. Brazing: Certify brazing procedures, brazers and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.
3. NSF Labels: Where plastic piping is indicated to transport potable water, provide pipes and pipe fittings bearing approval label by National Sanitation Foundation (NSF).
4. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

B. Pipe Testing Procedures: Contractor shall pressure test all piping systems in accordance with the following:

1. ASME Code for Pressure Piping B31, most current edition.
2. National Fire Protection Association (NFPA), all applicable sections, most current edition.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of pipe and pipe fitting. In addition, submit a matrix indicating each service and the proposed pipe material and fitting.

B. Welding Certifications: Submit reports as required for piping work.

C. Brazing Certifications: Submit reports as required for piping work.

D. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division-01.

1.4 DELIVERY, STORAGE AND HANDLING

A. Except for hub-and-spigot and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage, and eliminate dirt and moisture from inside of pipe and tube.

B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.

C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.1 GENERAL

A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service; where type, grade or class is not indicated. Provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.

B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.2 STEEL PIPES AND PIPE FITTINGS

A. Black Steel Pipe: ASTM A 53, A 106 or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.

B. Galvanized Steel Pipe: ASTM A 53 or A 120; except comply with ASTM A 53 where close coiling or bending is required.

C. Seamless Steel Pipe: ASTM A 53, A 106, or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.

D. Galvanized Seamless Steel Pipe: ASTM A 53 or A 120; except comply with ASTM A 53 where close coiling or bending is required.

E. Electric-Resistance-Welded Steel Pipe: ASTM A 135.

F. Electric-Fusion-Welded Steel Pipe: ASTM A 671, A 672, or A 691.

G. Stainless Steel Pipe: ASTM A 312; Grade TP 304.

H. Steel Water Pipe: AWWA C200 for pipe 6" (150 mm) and larger.

I. Coal Tar Protective Coatings and Linings for Steel Water Pipe: AWWA C203 for enamel and tape, hot applied.

J. Cast-Iron Flanged Fittings: ANSI B16.1, including bolting.

K. Cast-Iron Threaded Fittings: ANSI B16.4.

L. Malleable-Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.

M. Malleable-Iron Threaded Unions: ANSI B16.39; selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.

N. Threaded Pipe Plugs: ANSI B16.14.

O. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.

1. Material Group: Group 1.1.
2. End Connections: Buttwelding.
3. Facings: Raised-face.

P. Steel Pipe Flanges for Waterworks Service: AWWA C207.

Q. Corrosion-Resistant Cast Flanges/Fittings: MSS SP-51, including bolting and gasketing.

R. Forged-Steel Socket-Welding and Threaded Fittings: ANSI B16.11 except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.

S. Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns; rated to match connected pipe.

T. Stainless Steel Buttwelding Fittings: MSS SP-43.

U. Cast-Iron Threaded Drainage Fittings: ANSI B16.12.

V. Forged Branch-Connection Fittings: Except as otherwise indicated, provide type as determined by Installer to comply with installation requirements.

W. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2" (40 mm), and where pipe size is less than 1-1/2" (40 mm), and do not thread nipples full length (no close-nipples).

2.3 COPPER TUBE AND FITTINGS

A. Copper Type: ASTM B 88; Type (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated.

B. DWV Copper Tube: ASTM B 306.

C. ACR Copper Tube: ASTM B 280.

D. Cast-Copper Solder-Joint Fittings: ANSI B16.18.

E. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.

F. Cast-Copper Solder-Joint Drainage Fittings: ANSI B16.23.

G. Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29.

H. Cast-Copper Flared Tube Fittings: ANSI B16.26.

I. Bronze Pipe Flanges/Fittings: ANSI B16.24.

J. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.4 CAST-IRON PRESSURE PIPES AND PIPE FITTINGS

A. Ductile-Iron Pipe: ANSI A21.51; AWWA C151.

B. Polyethylene Encasement for Gray and Ductile Cast-Iron Piping: ANSI A21.5; AWWA C105.

C. Cast-Iron Fittings: AWWA C110.

D. Gray-Iron Fittings: AWWA C110.

E. Ductile-Iron Fittings: AWWA C110.

F. Rubber-Gasket Joints: AWWA C111.

2.5 CAST-IRON SOIL PIPES AND PIPE FITTINGS

A. Hubless Cast-Iron Soil Pipe: FS WW-P-401.

B. Cast-Iron Hub-and-Spigot Soil Pipe: ASTM A 74.

C. Hubless Cast-Iron Soil Pipe Fittings: Neoprene gasket complying with ASTM C 564 and stainless steel clamp holding band.

D. Cast-Iron Hub-and-Spigot Soil Pipe: Match soil pipe units; complying with same standards (ASTM A 74).

E. Compression Gaskets: ASTM C 564.

2.6 PLASTIC PIPE AND FITTINGS

A. Piping: Unplasticized, unpigmented, polypropylene. Materials shall comply with FDA, USDA,3A and USP XX Class VI sanitary standards. Pipe ferruled ends shall be field produced with factory supply flange former.

B. Fittings: Same resin as piping with molded sanitary ferruled ends. Fittings shall be joined with PVDF true union sanitary clamps and sealed with silicone gaskets. Pipe, fittings, gaskets, clamps and flange forming material shall be provided by same manufacturer.

2.7 GROOVED PIPING PRODUCTS

A. General: As Installer's option, mechanical grooved pipe couplings and fittings may be used only in mechanical rooms and areas where piping is installed above acoustic tile ceilings for the following systems in lieu of welded, flanged or threaded methods:

1. Fire protection

B. Coupling Housings:

1. Coupling Housings: Malleable iron conforming to ASTM A 47.
2. Coupling Housings: Ductile iron conforming to ASTM A 536.

C. Coupling Housings Description: Grooved mechanical type, which engages roll grooved pipe ends, encasing an elastomeric gasket which bridges pipe ends to create seal. Cast in two or more parts, secure together during assembly with nuts and bolts. Permit degree of contraction and expansion as specified in manufacturer's latest published literature.

D. Gaskets: Mechanical roll grooved coupling design, pressure responsive so that internal pressure serves to increase seal's tightness, constructed of elastomers having properties as designated by ASTM D 2000.

1. Water Services: EDPM Grade E, with green color code identification.
2. Other Services: As recommended by manufacturer.

E. Bolts and Nuts: Heat-treated carbon steel, ASTM A 183, minimum tensile 110,000 psi (758420 kPa).

1. Exposed Locations: Tamper resistant nuts.

F. Branch Stub-Ins: Upper housing with full locating collar for rigid positioning engaging machine-cut hole in pipe, encasing elastomeric gasket conforming to pipe outside diameter around hole, and lower housing with positioning lugs, secured together during assembly with nuts and bolts.

G. Fittings: Roll grooved end design to accept grooved mechanical couplings.

1. Malleable Iron: ASTM A 47.
2. Ductile Iron: ASTM A 536.
3. Fabricated Steel: ASTM A 53, Type F for 3/4" (20 mm) to 1-1/2" (40 mm): Type E or S, Grade B for 2" (50 mm) to 20" (500 mm).
4. Steel: ASTM A 234.

H. Flanges: Conform to Class 125 cast iron and Class 150 steel bolt hole alignment.

1. Malleable Iron: ASTM A 47.
2. Ductile Iron: ASTM A 536.

I. Roll Grooves: Conform to the following:

1. Lightweight Steel: Roll grooved.

2.8 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

A. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.

1. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

B. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements.

1. Tin-Antimony Solder: ASTM B 32, Grade 95TA.
2. Silver Solder: ASTM B 32, Grade 96TS.

C. Brazing Materials: Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.

1. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.

D. Gaskets for Flanged Joints: ANSI B16.21; full-faced or cast-iron raised face for steel flanges, unless otherwise indicated.

E. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" (1.6 mm) misalignment tolerance.

1. Comply with ANSI B31 Code for Pressure Piping.

B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Where trapping is unavoidable, install drain valve with 3/4" (20 mm) hose end connection, cap and chain. Provide access panels as required. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent enclosure elements of building; limit clearance to 1/2" (13 mm) where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" (25 mm) clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

C. Exposed piping in finished areas shall be covered with a 16 gauge steel cover primed and painted, secured to an adjacent structure and painted to match adjacent surfaces.

D. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces.

3.2 PIPING SYSTEM JOINTS

A. General: Provide joints of type indicated in each piping system.

1. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
2. Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.
3. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth

into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

B. Weld pipe joints in accordance with ASME Code for Pressure Piping, B31.

C. Weld pipe joints in accordance with recognized industry practice and as follows:

1. Weld pipe joints only when ambient temperature is above 0°F (-18°C) where possible.
2. Bevel pipe ends at a 37.5˚ angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.
3. Use pipe clamps or tack-weld joints with 1" (25 mm) long welds; 4 welds for pipe sizes to 10" (250 mm), 8 welds for pipe sizes 12" (300 mm) to 20" (500 mm).
4. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.
5. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.
6. At Installer's option, install forged branch-connection fittings wherever branch pipe is indicated; or install regular "T" fitting.

D. Weld pipe joints of steel water pipe in accordance with AWWA C206.

E. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

F. Lead Joint Installation: Tightly pack joint with joint packing material. Do not permit packing to enter bore of finished joint. Clean joint after packing. Fill remaining joint space with one pouring of lead to indicated minimum depth measured from face of bell. After lead has cooled, caulk joint tightly by use of hammer and calking iron.

G. Hubless Cast-Iron Joints: Comply with coupling manufacturer's installation instructions.

H. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards:

1. Heat Joining of Thermoplastic Pipe: ASTM D 2657.
2. Making Solvent-Cemented Joints: ASTM D 2235, and ASTM F 402.

I. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions.

3.3 PIPING INSTALLATION

A. Install drain tile piping from lowest end of slope to highest, solidly bedded in filtering or drainage fill. Shape bed for bells of piping (if any). Place bells/hubs and grooved ends of units up-stream. Lay perforated pipe with perforations

down. Refer to Division-2 specifications for filter cloth, bedding material and backfill installation requirements.

B. Install ductile cast-iron water mains and appurtenances in accordance with-AWWA C600.

3.4 PIPE TESTING

A. The mechanical contractor shall air and/or hydrostatically test the following systems in accordance with the latest ASME B31 (ASME Code for Pressure Piping) and NFPA requirements.

1. Air Test:

a. Air, Gas and Vacuum

2. Hydrostatic Test:

a. Domestic Water

B. Pressure tests shall also be performed prior to the installation of all insulation materials.

C. Hydrostatic Test: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed, wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.

1. Required test period is four (4) hours.
2. Hydrostatically test each piping system at 150% of operating pressure indicated, but not less than 100 psi (690 kPa) test pressure.
3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds less than one percent (1.0%) of test pressure.
4. Upon completion of roughing-in and before setting fixtures, the entire new domestic water system shall be tested. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately in a manner described for the entire system.
5. Prior to testing, verify the pressures listed above are in accordance with the latest ASME B31 code and NFPA. Should a discrepancy exist between the ASME B31 code, NFPA, and/or the pressures indicated above, contact the Engineer prior to testing.

D. Air Test:

1. Air, gas and vacuum piping shall be air tested at 200 psi (1380 kPa).
2. Prior to testing, verify the pressures listed above are in accordance with the latest ASME B31 code and NFPA. Should a discrepancy exist between the ASME B31 code, NFPA, and/or the pressures indicated above, contact the Engineer prior to testing.

E. Sanitary and Storm Water Piping Systems:

1. All soil, waste, vent and storm water piping shall be tested by the Contractor and reviewed by the Architect before acceptance. All piping located underground shall be tested before backfilling. The costs of all equipment required for tests are to be included under the contract price.
2. The entire new drainage system and venting system shall have all necessary openings plugged and filled with water to the level of the highest vent stack above the roof. The system shall hold this water for four (4) hours without showing a drop in water level. Where a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system, except a vertical stack 10 feet (3000 mm) above the highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure, or a pump may be used to supply the required pressure.

F. Drain test water from piping systems after testing and repair work has been completed.

G. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

3.5 CLEANING, FLUSHING, INSPECTING

A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

1. Inspect pressure piping in accordance with procedures of ASME B31.

B. Disinfect water mains and water service piping in accordance with AWWA C601.

C. After final testing for leaks, all new potable water lines shall be thoroughly flushed by plumbing contractor to remove foreign material. Before placing the systems in service, Contractor shall engage a qualified service organization, to sterilize the systems in accordance with the following procedure:

1. Through a 3/4" (20 mm) hose connection in the main entering the building, pump in sufficient sodium hypochlorite to produce a free available chlorine residual of not less than 200 PPM. Plumbing contractor shall provide plumbing connections and power for pumping chlorine into the system.
2. Proceed upstream from the point of chlorine application opening all faucets and taps until chlorine is detected. Close faucets and taps when chlorine is evident.
3. When chlorinated water has been brought to every faucet and tap with a minimum concentration of 200 PPM chlorine, retain this water in the system for three hours.

CAUTION: Over-concentration of chlorine and more than three (3) hours of retention may result in damage to piping system.

4. At the end of the retention period, no less than 100 PPM of chlorine shall be present at the extreme end of the system.
5. Proceed to open all faucets and taps and thoroughly flush all new lines until the chlorine residual in the water is less than 1.0 PPM.
6. Obtain representative water samples from the system for analysis by a recognized bacteriological laboratory.
7. If the sample tested for coliform organisms is negative, a letter and laboratory reports shall be submitted by the service organization to the Contractor, certifying successful completion of the sterilization.
8. If any samples tested indicate the presence of coliform organisms, the entire sterilization procedure shall be repeated.

END OF SECTION 22 05 14

SECTION 22 05 15

PIPING SPECIALTIES FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of piping specialties work required by this section is indicated on drawings and schedules and by requirements of this section.

B. Types of piping specialties specified in this section include the following:

1. Pipe Escutcheons
2. Pipeline Strainers
3. Vandal-Proof Vent Caps
4. Dielectric Fittings
5. Mechanical Sleeve Seals
6. Penetration Seals
7. Water Hammer Arresters
8. Drip Pans
9. Pipe Sleeves
10. Sleeve Seals
11. Flexible Connectors
12. Domestic Water Mixing Valve
13. Electric Pipe Trace

C. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-22 sections.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. FCI Compliance: Test and rate "Y" type strainers in accordance with FCI 73-1 "Pressure Rating Standard for "Y" Type Strainers". Test and rate other type strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than "Y" Type".
2. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.

B. Shop Drawings: Submit for fabricated specialties, indicating fabrication, materials, and method of support.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 PIPING SPECIALTIES

A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections.

2.2 PIPE ESCUTCHEONS

A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

2.3 LOW PRESSURE Y-TYPE PIPELINE STRAINERS

A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi (850 kPa) working pressure, with Type 304 stainless steel screens, with perforations as follows:

1. Piping 2" (50 mm) and Smaller: 1/32" (.8 mm) diameter perforations.
2. Piping 2-1/2" (65 mm) and Larger: 3/64" (1.2 mm) diameter perforations for water systems and 1/16" diameter perforations for steam systems.

B. Threaded Ends, 2" (50 mm) and Smaller: Brass, screwed screen retainer with centered blowdown fitted with valve and pipe plug.

C. Threaded Ends, 2-1/2" (65 mm) and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.

D. Flanged Ends, 2-1/2" (65 mm) and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.

E. Butt Welded Ends, 2-1/2" (65 mm) and Larger: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.

F. Grooved Ends, 2-1/2" (65 mm) and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EDPM gasket.

2.4 HIGH PRESSURE Y-TYPE PIPELINE STRAINERS

A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 250 psi 1724 kPa) working pressure, with Type 304 stainless steel screens, with 3/64" (1.2 mm) perforations @ 233 per sq. in.

B. Threaded Ends, 2" (50 mm) and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with valve and pipe plug.

C. Threaded Ends, 2-1/2" (65 mm) and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.

D. Flanged Ends 2-1/2" (65 mm) and Larger: Cast-iron body, bolted steel retainer with off-center blowdown fitted with valve and pipe plug.

E. Butt Welded Ends, 2-1/2" (65 mm) and Larger: Schedule 80 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.

2.5 VANDAL-PROOF VENT CAPS

A. General: Provide cast-iron vandal-proof vent caps, full size of vent pipe, caulked base connection for cast-iron pipes, threaded base for steel pipes.

2.6 DIELECTRIC FITTINGS

A. General: Provide assembly or fitting having insulating material to isolate dissimilar metals to prevent galvanic action and stop corrosion.

1. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

    a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035 kPa or 2070 kPa) minimum working pressure to suit system pressures.

2. Dielectric Nipples: Electroplated steel nipple, having inert and non-corrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig (2070 kPa) working pressure at 225°F (107°C) temperature.
3. Dielectric unions shall NOT be acceptable.

2.7 MECHANICAL SLEEVE SEALS

A. General: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.8 PENETRATION SEALS

A. Provide seals for all openings through fire-rated walls, floors, or ceilings used as passage for mechanical piping. See Division-22 Section “Basic Plumbing Materials and Methods” for penetration seals and firestopping requirements.

B. Provide seals for all openings through walls, floors or ceilings used as passage for mechanical components such as piping.

2.9 WATER HAMMER ARRESTERS

A. General: Provide bellows type water hammer arresters, stainless steel casing and bellows, pressure rated for 250 psi (1724 kPa), tested and certified in accordance with PDI Standard WH-201.

2.10 FABRICATED PIPING SPECIALTIES

A. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2" (65 mm). Reinforce top, either by structural angles or by rolling top over 1/4" (6 mm) steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" (25 mm) drain line connection.

B. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" (75 mm) and smaller, 20 gage (1.0 mm); 4" to 6" (100 mm to 150 mm), 16 gage (1.6 mm); over 6" (150 mm), 14 gage (2 mm).
2. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.

2.11 FLEXIBLE CONNECTORS

A. Furnish and install braided stainless steel flexible connectors where indicated on drawings. Construction shall be of annular corrugated stainless steel close-pitch hose with stainless steel overbraid.

1. The corrugated metal hose, braids, and a stainless steel ring-ferrule/band (material gauge not less than .048") (material gauge not less than 1.2 mm) shall be integrally welded using a 100% circumferential, full-penetration TIG weld.

2. End fittings shall be flat-face plate steel flanges with 150#ANSI drilling and outside diameter. Fittings shall be attached using a 100% circumferential TIG/MIG weld.
3. Braided stainless steel connectors shall be suitable for operating temperatures up to 850°F (454°C).
4. The rated working pressure of braided metal hose shall have a minimum 4:1 safety factor based on an operating temperature of 70°F (20°C). Each braided stainless steel connector shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure.
5. Flanged connectors shall be prepared for shipment using cut-to-length spacers, securely positioned between the flanges to prevent axial compression damage and maintain the manufactured length. Spacers must be removed prior to system start-up.
6. All braided stainless steel connectors shall be covered by a three (3) year warranty.
7. Minimum overall lengths shall be as follows:

Through 4" (100 mm) diameter:	9" (225 mm)
5" (125 mm), 6" 150 mm) diameter:	11" (275 mm)
Over 6" (150 mm) diameter:	1.5 times nominal diameter

2.12 DOMESTIC WATER VALVE

A. Thermostatic and Pressure Mixing Valve:

1. Furnish and install where indicated on the floor plans. Refer to floor plans/details for manufacturer, size, model and setting. Mixing valve for tempered water controls shall be of the thermostatic type with liquid sensor and shall be in accordance with ASSE 1017. Valve shall be constructed of a bronze body with internal non-corrosive parts. Valve construction shall employ poppets which are independently seated, balanced, and self-aligning. Union inlets with strainers and check stops shall be provided. Temperature adjustment control shall be tamper-resistant. Provide thermometer on outlet and valved inlets.

2.13 ELECTRIC PIPE TRACING

A. Furnish and install self-regulating pipe trace heater consisting of two (2) 16 AWG nickel plated copper bus parallel wires embedded in a self-regulating polymer core that varies its power output to respond to temperature along its length, allowing the heater to cross over itself without overheating, and to be cut to length in the field. The heater shall be covered by a radiation cross linked polyethylene dielectric jacket rated at 300 VAC at 222°F (105°C) with VW-1 flame resistance.

B. The heater shall operate on line voltage 120V, without the use of transformers.

C. The heater shall be sized according to the following table. The output rating is in watts per linear foot at 50˚F (10˚C).

Pipe Size	Heater Capacity
1/2 - 1 inch (13 mm - 25 mm)	3 W/LF (1 W/m)
1-1/4 - 2 inch (32 mm - 50 mm)	5 W/LF (1.6 W/m)
3 inch (75 mm)	5 W/LF (1.6 W/m)
4 inch (100 mm)	8 W/LF (2 W/m)
6 inch (150 mm)	8 W/LF (2 W/m)
8 inch (200 mm)	2 strips - 8 W/LF (2 W/m)
10 - 14 inch (250 mm - 350 mm)	2 strips - 8 W/LF (2 W/m)

D. All heating cable cores shall be permanently marked with manufacturer's batch or serial number for traceability. All cable jackets shall be continuously marked with manufacturer's name, catalog number, nominal supply voltage and nominal power output in watts per foot. Use of temporary printing or tags not permitted.

E. All cables shall be capable of withstanding 1,600 VAC RMS (50 to 60 HZ) applied for one minute between the parallel conductors and the metallic braid.

F. Power retention of the heating element shall be a minimum of 90% after a minimum of 30 thermal cycles between 50°F and 150°F (10°C and 66°C).

G. Power connection, end seal, splice and tee kit components shall be applied in the field.

H. The system shall be controlled by an ambient sensing thermostat set at 40°F.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration thru floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

B. Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2" (50 mm) and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to drain, full size of blow down connection.

1. Locate Y-type strainers ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment:

a. Pumps
b. Pressure reducing valves
c. Temperature or pressure regulating valves

C. Vandal-Proof Vent Caps: Install vandal-proof vent caps on each vent pipe passing through roof, and elsewhere as indicated. Locate base of vent cap 6" (150 mm) above roof surface, or higher where required by Code.

D. Dielectric Fittings: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

E. Mechanical Sleeve Seals: Provide mechanical sleeve seals for sleeves located in foundation walls below grade, or in exterior walls. Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.

F. Water Hammer Arresters: Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, and elsewhere as indicated.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES

A. Drip Pans: Locate drip pans under piping passing over or within 3' (0.9 m) horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" (25 mm) drain line to drain connection, and run to nearest drain as indicated.

B. Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by the Owner. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than two (2) pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Sleeves through floors shall be flush with the floor, except for sleeves passing through equipment rooms, toilet rooms (and other wet areas) which shall extend 3/4" (20 mm) above the floor. Space between the pipe and sleeve shall be caulked. Escutcheons plates shall be constructed to conceal the ends of sleeves. Extend floor sleeves 1/4" (6 mm) above level floor finish and 3/4" (20 mm) above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

1. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings.
2. Install iron-pipe sleeves at exterior and interior foundation wall penetrations, both above and below grade. Penetrations shall be sealed weathertight.
3. Install steel-pipe except as otherwise indicated.

3.3 INSTALLATION OF ELECTRIC PIPE TRACING

A. Provide electric heat trace for all exterior piping, located above the local frost line, including, but not limited to, exterior chilled water piping, and for all evaporator condensate drain piping within Freezer and Refrigerator Boxes in the kitchen area.etc.

B. Install the heater linearly on the pipe after piping has been successfully pressure tested. Secure the heater to piping with cable ties or type PF-1 polyester tape.

C. Apply "electric traced" signs to the outside of the thermal insulation.

D. Tests:

1. After installation and before and after installing the thermal insulation, subject heat to testing using a 1000 VDC megger. Minimum installation resistance should be 20 to 1000 megohms regardless of length.

3.4 INSTALLATION OF FLEXIBLE PIPE CONNECTORS

A. Provide flexible pipe connectors on the inlet and outlet of piping connected to a vibrating piece of equipment. Flexible connectors shall be full line size as indicated on the drawings and should be provided with control rods.

END OF SECTION 22 05 15

SECTION 22 05 16

EXPANSION COMPENSATION FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of expansion compensation products required by this section is indicated on drawings and/or specified in other Division-22 sections.

B. Types of expansion compensation products specified in this section include the following:

1. Packless Expansion Joints:

a. Expansion Compensators

2. Expansion Loops

C. Expansion compensation products furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-22 sections.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. EJMA Compliance: Construct compensation products in accordance with standards of the Expansion Joint Manufacturer's Association (EJMA).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of expansion compensation product. Submit expansion compensation schedule showing manufacturer's figure number, size, location, and features for each required expansion compensation product.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of expansion compensation product, indicating dimensions, weights, required clearances, and methods of assembly of components.

C. Shop Drawings: Submit shop drawings for fabricated expansion loops indicating location, dimensions, pipe sizes, and location and method of attachment of anchors.

D. Maintenance Data: Submit maintenance data and spare parts lists for each type of expansion compensation product. Include this data, product data, and shop drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include the following:

1. Flexonics Inc., Metal Hose and Expansion Joint Div.
2. Keflex HVAC Products, Flex-Weld, Inc.
3. Metraflex Co.
4. Mason Industries, Inc.
5. Vibration Mountings and Controls, Subsidiary of ARX.

2.2 PACKLESS EXPANSION JOINTS

A. General: Provide packless expansion joints where indicated for piping systems, with materials and pressure/temperature ratings selected by installer to suit intended service. Select packless expansion joints to provide 200% absorption capacity of piping expansion between anchors.

B. Expansion Compensators: Pressure rated for 60 psi (415 kPa) for low pressure systems, 175 psi (1200 kPa) for high pressure systems; 2-ply phosphor bronze bellows, brass shrouds and end fittings for copper piping systems, or 2-ply stainless steel bellows, carbon steel shrouds and end fittings for steel piping systems. Provide internal guides and anti-torque device, and removable end clip for proper positioning.

2.3 MISCELLANEOUS MATERIALS

A. Pipe Alignment Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which expansion compensation products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 EXPANSION JOINTS

A. General: Install expansion joints where indicated, and elsewhere as required for adequate expansion of installed piping system. Install in accordance with manufacturer's instructions. Provide pipe anchors and pipe alignment guides as indicated, and in accordance with manufacturer's recommendations. Align units properly to avoid end loading and torsional stress.

3.3 EXPANSION LOOPS

A. General: Fabricate expansion loops as indicated, in locations indicated, and elsewhere as required for adequate expansion of installed piping system. Subject loop to cold spring which will absorb 50% of total expansion between hot and cold conditions. Provide pipe anchors and pipe alignment guides as required to properly anchor piping in relationship to expansion loops.

3.4 EXPANSION COMPENSATION FOR RISERS AND TERMINALS

A. General: Install connection between piping mains and risers with at least five (5) pipe fittings including tee in main. Install connections between piping risers and terminal units with at least four (4) pipe fittings including tee in riser.

3.5 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principle pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION 22 05 16

SECTION 22 05 19

METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of meters and gauges required by this section is indicated on drawings and/or specified in other Division-22 sections.

B. Types of meters and gauges specified in this section include the following:

1. Temperature Gauges and Fittings:

   a. Direct Mount Dial Thermometers
   b. Remote Reading Dial Thermometers
   c. Thermometer Wells

2. Pressure Gauges and Fittings:

   a. Pressure Gauges
   b. Pressure Gauge Cocks
   c. Pressure Gauge Connector Plugs

C. Meters and gauges furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-22 sections.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.
2. ANSI and ISA Compliances: Comply with applicable portions of Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.
3. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

B. Certification: Provide meters and gauges whose accuracies, under specified operating conditions, are certified by manufacturer.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and

gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

B. Maintenance Data: Submit maintenance data and spare parts lists for each type of meter and gauge. Include this data in Maintenance Manual.

PART 2 - PRODUCTS

2.1 DIRECT MOUNT DIAL THERMOMETERS

A. General: Provide direct mount dial thermometers of materials designed and constructed for use in service indicated.

B. Type: Vapor tension, universal angle.

C. Case: Drawn steel or brass, glass lens, 5" (125 mm) diameter. For gauges mounted above eight feet (2400 mm), 8" (200 mm) diameter gauge.

D. Adjustable Joint: Die cast aluminum, 180 degree adjustment in vertical plane, 360 degree adjustment in horizontal plane, with locking device.

E. Thermal Bulb: Copper with phosphor bronze bourdon pressure tube, one scale division accuracy.

F. Movement: Brass precision geared.

G. Scale: Progressive, satin faced, non-reflective aluminum, permanently etched markings.

H. Stem: Copper plated steel, or brass, for separable socket, length to suit installation.

I. Range: Conform to the following:

1. Hot Water: 30°F - 240°F (-1°C - 116°C).

2.2 REMOTE READING DIAL THERMOMETERS

A. General: Provide remote reading dial thermometers of materials designed and constructed for use in service indicated.

B. Type: Vapor tension.

C. Case: Drawn steel or brass, glass lens, 5" (125 mm) diameter. For gauges mounted above eight feet (2400 mm), 8" (200 mm) diameter shall be used.

D. Movement: Brass, precision geared.

E. Tubing: Bronze double braided armor over copper capillary, length to suit installation.

F. Bulb: Copper with separable socket for liquids, averaging element for air.

G. Accuracy: ± one scale division.

H. Range: Conform to the following:

1. Hot Water: 30°F - 240°F (-1°C - 116°C).

2.3 THERMOMETER WELLS

A. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" (50 mm) extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

B. Manufacturer: Same as thermometers.

2.4 PRESSURE GAUGES

A. General: Provide pressure gauges of materials designed and constructed for use in service indicated.

B. Type: General use, 1% accuracy, ANSI B 40.1 Grade A, phosphor bronze bourdon type, bottom connection.

C. Case: Drawn steel or brass, glass lens, 5" (125 mm) diameter. For gauges mounted above eight feet (2400 mm), 8" (200 mm) gauges shall be used.

D. Connector: Brass with 1/4" (6 mm) male NPT.

E. Scale: White coated aluminum, with permanently etched markings.

F. Range: Conform to the following:

1. Vacuum: 30" Hg (102 kPa) - 15 psi (103 kPa).
2. Water: 0 - 100 psi (0 - 690 kPa).

2.5 PRESSURE GAUGE COCKS

A. General: Provide pressure gauge cocks between pressure gauges and gauge tees on piping systems. Construct gauge cock of brass with 1/4" (6 mm) female NPT on each end, and "T" handle brass plug.

B. Syphon: 1/4" (6 mm) straight coil constructed of brass tubing with 1/4" (6 mm) male NPT on each end.

C. Snubber: 1/4" (6 mm) brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

D. Manufacturer: Same as for pressure gauges.

2.6 PRESSURE GAUGE CONNECTOR PLUGS

A. General: Provide pressure gauge connector plugs pressure rated for 500 psi (3448 kPa) and 200°F (93°C). Construct of brass and finish in nickel plate, equip with 1/2" (13 mm) NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" (3 mm) O.D. probe assembly from dial type insertion pressure gauge. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which meters and gauges are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TEMPERATURE GAUGES

A. General: Install temperature gauges in vertical upright position, and tilted so as to be easily read by observer standing on floor.

B. Locations: Install direct mounted thermometers in the following locations, and elsewhere as indicated:

1. At inlet and outlet of each heat exchanger.
2. At suction and discharge of each pump.
3. At discharge of each domestic water heater.
4. At inlet and outlet of each thermal storage tank.

C. Remote Reading Dial Thermometers: Install on control panels as indicated. Run tubing between panel and thermometer bulb, adequately supported to prevent kinks. Select tubing length so as to not require coiling of tubing.

D. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical upright position. Fill well with oil or graphite, secure cap.

3.3 INSTALLATION OF PRESSURE GAUGES

A. General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position.

B. Locations: Install in the following locations, and elsewhere as indicated:

1. At suction and discharge of each pump.
2. At inlet and outlet of each pressure reducing valve.
3. At incoming services (domestic water, fire and gas).
4. At inlet and outlet of large strainers.
5. At inlet and outlet of heat exchangers.
6. At inlet of expansion tanks.
7. At the top of each standpipe riser.
8. At inlet and outlet of backflow preventors.

C. Pressure Gauge Cocks: Install in piping tee with snubber.

D. Pressure Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.4 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked or broken windows and repair any scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION 22 05 19

SECTION 22 05 23

VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of valves required by this section is indicated on drawings and/or specified in other Division-22 sections.

B. Types of valves specified in this section include the following:

1. Gate Valves
2. Globe Valves
3. Drain Valves
4. Ball Valves
5. Butterfly Valves
6. Check Valves

C. System Descriptions:

1. Domestic Water Piping: Domestic water piping shall relate to potable and non-potable cold water, hot water and hot water recirculating piping systems.
2. Dental Gas Piping: Dental gas piping shall relate to dental air and dental vacuum systems.

D. Valves furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division-22 sections.

1.2 QUALITY ASSURANCE

A. Valve Types: Provide valves of same type by same manufacturer.

B. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating and size clearly marked on valve body.

C. Codes and Standards:

1. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".
2. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".
3. UL and FM Compliance: Provide valves used in fire protection piping, which are UL-listed and FM approved.
4. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61- G).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing manufacturer's figure number, size, location, and valve features for each required valve.

B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of valve. Include this data, product data, and shop drawings in Maintenance Manual.

PART 2 - PRODUCTS

2.1 VALVES - GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following, unless otherwise noted:

1. Milwaukee
2. Bray
3. Apollo
4. DeZurik
5. Jamesbury
6. Watts

B. Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide end connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

C. Size: Unless otherwise indicated, provide valves of same size as upstream pipe size. Pipe size reduction shall be made after valve assembly.

D. Valve Features: Provide the following as required:

1. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ASME B31.9 for building services piping, and ASME B31.1 for power piping.
2. Bypass: Comply with MSS SP-45, and except as otherwise indicated, provide manufacturer's standard bypass piping and valving.
3. Drain: Comply with MSS SP-45, and provide threaded pipe plugs.
4. Flanged: Valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5, (steel), or ANSI B16.24 (bronze).
5. Threaded: Valve ends complying with ANSI B2.1.
6. Butt-Welding: Valve ends complying with ANSI B16.25.
7. Socket-Welding: Valve ends complying with ANSI B16.11.

8. Solder-Joint: Valve ends complying with ANSI B16.18.
9. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).
10. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6" (150 mm) and smaller. Provide gear operators for quarter-turn valves 8" (200 mm) and larger. Provide chain-operated sheaves and chains for overhead valves as indicated.

2.2 GATE VALVES

A. Comply with the following standards:

1. Cast-Iron Valves: MSS SP-70.
2. Bronze Valves: MSS SP-80.
3. Steel Valves: ANSI B16.34.

B. Fire Department Valves (Standpipes):

1. Hose End; 2-1/2" (65 mm): FM, 175 psi (1200 kPa), bronze body, solid wedge, inside screw, non-rising stem, with cap and chain.

C. Fire Protection and Incoming Water Services:

1. Threaded End; 2" (50 mm) and Smaller: FM, UL-listed, 175 psi (1200 kPa), bronze body, solid wedge, outside screw and yoke, rising stem. Milwaukee Model 118 or equivalent.
2. Flanged End; 2-1/2" (65 mm) and Larger: FM, UL-listed, 175 psi (1200 kPa), iron body bronze mounted, solid wedge, outside screw and yoke, rising stem. Milwaukee Model F2885FP or equivalent.

2.3 GLOBE VALVES

A. Comply with the following standards:

1. Cast-Iron Valves: MSS SP-85.
2. Bronze Valves: MSS SP-80.
3. Steel Valves: ANSI B16.34.

B. Domestic Water Piping:

1. 2" (50 mm) and Smaller: Class 150, bronze body, union bonnet, integral seat, renewable TFE disc. Milwaukee Model 590T (Threaded), 1590T (Sweat) or equivalent.
2. Flanged Ends; 2-1/2" (65 mm) and Larger: Class 125, iron body, bolted bonnet, renewable seat and disc, bronze mounted. Milwaukee Model F2981A or equivalent.

2.4 DRAIN VALVES

A. Comply with the following standards:

1. Water Heater Drain Valves: ASSE 1005.

B. Domestic Water Piping:

1. 3” (75 mm) and Smaller: Class 125, bronze body ball valve with chrome plated ball, hose end with cap and chain. Milwaukee BA100H (Threaded), Milwaukee BA150H (Sweat) or equivalent.

2.5 BALL VALVES

A. Comply with the following standards:

1. Bronze Valves: MSS SP-110.
2. Potable Water: NSF-61-8.

B. Domestic Water Piping:

1. 2” (50 mm) and Smaller: Valves shall be rated 150 psi (1035 kPa) SWP and 600 psi (4140 kPa) non-shock WOG and shall have 2-piece cast ASTM B 584 bronze bodies, TFE seats, standard port, separate packing nut with adjustable stem packing, anti-blowout stems and stainless steel ball. Valve ends shall have full depth ANSI threads or extended solder connections and be manufactured to comply with MSS-SP110. Milwaukee BA100S (Threaded), BA150S (Sweat) or equivalent. For potable water applications provide NSF/ANSI 1372 (NSF-61-G) compliant “lead free” valves; Milwaukee UPBA 100/150 or equivalent.

C. Natural Gas Service:

1. 2” (50 mm) and Smaller: 600 lb WOG, 150 lb SWP, 2 piece body style, full port, chrome plated ball, bronze body of ASTM B283 forged brass body, hex gland follower, blow out proof stem, lever handle. Valves shall be CSA, UL and FM approved. Milwaukee BA 475 (Threaded) or equivalent.
2. 2-1/2” (65 mm) and larger: Consult valve manufacturer for suggested valve over 2” for gas service (Milwaukee does not offer a gas agency approved valve over 2”)

D. Dental Gases:

1. 2” (50 mm) and Smaller: 600 lb WOG, 150 lb SWP, 3 piece body style, full port, chrome plated ball, bronze body of ASTM B584, blow out proof stem, lever handle. Valve shall have extended tube ends of 1/8” gauge port, shall be cleaned and capped for dental gas service and shall be NFPA compliant. Milwaukee BA 350TE-G-OC or equivalent.
2. 2-1/2” (65 mm) and larger: Consult valve manufacturer for suggested valve over 2” for dental gas service (Milwaukee does not offer a valve for this service over 2”.)

E. Where piping is insulated, ball valves shall be equipped with 2" (50 mm) extended handles of non-thermal conductive material. Also, provide a protective sleeve that allows operation of the valve without breaking the vapor seal or

disturbing the insulation. Memory stops, which are fully adjustable after insulation is applied, shall be included.

2.6 BUTTERFLY VALVES

A. General: Comply with MSS SP-67. Where butterfly valves are used as shutoffs for terminal or equipment removal or repair, select bubble tight, lug body type valves suitable for dead end service.

B. Domestic Water Piping:

1. 2-1/2" (65 mm) to 6" (150 mm): 200 psi (1380 kPa), ductile iron, ASTM A 536 lug body. EPDM seat, 316 SS disc and stem, lever operated. Milwaukee model ML224E or equivalent. For food and beverage applications, provide Milwaukee model ML224NW or equivalent. For potable water applications provide NSF/ANSI 372 (NSF 61- G) compliant "lead free" valves; Milwaukee ML 233E (lever operated), Milwaukee ML 333E (gear operated) or equivalent.
2. 8" (200 mm) and Larger: 200 psi (1380 kPa), ductile iron, ASTM A 536 lug body. EPDM seat, 316 SS disc and stem, gear operated. Milwaukee model ML324E or equivalent. For food and beverage applications, provide Milwaukee model ML324NW or equivalent. For potable water applications provide NSF/ANSI (NSF 61-G) compliant "lead-free" valves; Milwaukee ML 333E or equivalent.
3. All valves shall be capable of bubble tight dead end service in either direction without use of additional pinning, screws or mating flanges.

2.7 CHECK VALVES

A. Comply with the following standards:

1. Cast-Iron Valves: MSS SP-71.
2. Bronze Valves: MSS SP-80.
3. Steel Valves: ANSI B16.34.

B. Domestic Water Piping:

1. 2" (50 mm) and Smaller: Class 150, bronze body, horizontal swing, T pattern with renewable TFE disc. Milwaukee 510T (Threaded), 1510T (Sweat) or equivalent.

2. 2-1/2" (65 mm) and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends. Milwaukee F2974A or equivalent.

C. Fire Protection:

1. 2-1/2" (65 mm) and Larger; FM: 175 psi (1200 kPa), iron body bronze mounted, renewable composition disc and bronze seat ring, bolted cover, flanged ends. Milwaukee F2974FP or equivalent.

2.8 BALANCE VALVES

A. Plumbing: For potable water applications, valves shall be “lead-free” in accordance with local, state and federal codes, as well as, NSF/ANSI 372 (NSF 61-G). Balance valves for hot water recirculating systems shall be venturi type with an accuracy of 3% at full scale; RWV or equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Except as otherwise indicated, comply with the following requirements.

1. Install valves where required for proper operation of piping and equipment, including valves in branch lines, service mains and all equipment connections. Locate valves so as to be accessible and so that separate support can be provided when necessary.
2. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

B. Insulation: Where insulated, install extended-stem valves, arranged in proper manner to receive insulation.

C. Mechanical Actuators: Install mechanical actuators with chain operators where indicated. Extend chains to approximately five feet (1500 mm) above floor and secure to clips to clear aisle passage.

D. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with connections to match pipe fittings.

E. Renewable Seats: Install valves with renewable seats, where applicable.

F. Fluid Control: Except as otherwise indicated, install gate, ball, globe, and butterfly valves to comply with ANSI B31.9. Where throttling is indicated or recognized as principle reason for valve, install ball, globe or butterfly valves, as indicated.

G. Installation of Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.

3.2 ADJUSTING AND CLEANING

A. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.

B. Valve Identification: Tag each valve in accordance with Division-22 section "Identification for Plumbing Piping and Equipment".

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 22 05 23

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of hangers and supports required by this section is indicated on drawings and/or specified in other Division-22 sections.

B. Types of hangers and supports specified in this section include the following:

1. Horizontal-Piping Hangers and Supports
2. Vertical-Piping Clamps
3. Hanger-Rod Attachments
4. Building Attachments
5. Saddles and Shields
6. Spring Hangers and Supports
7. Miscellaneous Materials
8. Roof Equipment Supports
9. Anchors
10. Equipment Supports

C. Hangers and supports furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-22 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of hangers and supports, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. Code Compliance: Comply with applicable codes pertaining to product materials and installation of hangers and supports.
2. NFPA, UL, and FM Compliance: Provide products which comply with NFPA 13 listed and labeled by UL and FM where used for fire protection piping systems.
3. MSS Standard Compliance:

a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
b. Select and apply pipe hangers and supports, complying with MSS SP-69.
c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
d. Terminology used in this section is defined in MSS SP-90.

PART 2 - PRODUCTS

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, selected by Installer to suit horizontal-piping systems in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.2 VERTICAL-PIPING CLAMPS

A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SP-58, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.3 HANGER-ROD ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.4 BUILDING ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.5 SADDLES AND SHIELDS

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

2.6 SPRING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated spring hangers and supports complying with MSS SP-58, selected by Installer to suit piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select spring hangers and supports to suit pipe size and loading.

2.7 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2).

D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which hangers and supports are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BUILDING ATTACHMENTS

A. Install attachments at required locations within concrete steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi (17240 kPa) is indicated, install reinforcing bars through openings at top of inserts.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Support fire-water piping independently of other piping.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

E. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

F. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

H. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold water piping, install coated protective shields.
3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

4. For all insulated piping 2-1/2” (63 mm) and larger, provide insulated saddles as follows:

   a. For domestic hot and cold water piping, provide the following:

      1) Minimum 3.75 pcf, non-compressive, rigid, phenolic foam insulation. Fire and smoke rating shall be 25/50 or below per ASTM 84.
      2) For cold applications below 75ºF (24ºC) a zero permeability, abuse resistant, vapor barrier shall be provided with matching butt strips. Apply a full coating of butyl joint sealant in addition to the butt strips for a completely sealed system.
      3) The phenolic foam system shall have a K factor of 0.16 at a mean temperature for 75ºF (24ºC) and comply with ASTM Standard C1126.
      4) Provide visible inspection sticker at the bottom of each saddle.
      5) Pipe insulation saddles shall be Tru-Balance CoolDry Saddles as manufactured by Buckaroos, Inc. or equivalent.

I. Spacing: Hanger spacing for piping shall not exceed 8 feet (2400 mm) on centers for pipe 1-1/4" (32 mm) or smaller, and 10 feet (3 m) for pipe 1-1/2" (40 mm) and larger. Regardless of spacing, hangers shall be provided at or near all changes in direction, both vertical and horizontal, for all piping. For cast iron soil pipe, one hanger shall be placed at each hub or bell.

3.4 ADJUSTMENT OF HANGERS AND SUPPORTS

A. Adjust hangers and supports and place grout as required under supports to bring piping to proper levels and elevations.

3.5 EQUIPMENT SUPPORTS

A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division-22. Size bases to extend minimum of 4" (100 mm) beyond equipment base in any direction; and 4" (100 mm) above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

3.6 PAINTING

A. All hangers, supports, clamps and assemblies shall be primed and painted with rust inhibitors.

END OF SECTION 22 05 29

SECTION 22 05 48

VIBRATION ISOLATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: The extent of vibration isolation work to be provided under this Contract is covered by the requirements of this Section, all Division-22 specifications, and the Contract Drawings including structural, architectural, mechanical and electrical which identify equipment and systems requiring vibration isolation treatment.

B. Types: Types of vibration isolation equipment and systems specified in this Section include:

TYPE	DESCRIPTION
1 Isolator	Ribbed Neoprene Pads
2I Isolator	Neoprene-In-Shear Type
2H Hanger	Rubber-In-Shear Type
3I Isolator	Open Spring Type
3H Hanger	Combination Spring and Neoprene Type
4 Isolator	Vertically Restrained Spring Isolators
5 Thrust	Restraints Spring Type Installed in Pairs

C. Selection of Isolators: Provide isolators selected by a vibration isolator equipment specialist.

1. Conform to isolator types herein specified.
2. Examine the contract drawings for sizes, horsepowers, rotational speeds, equipment location, length of span between columns and beams and construction type to determine the isolator selection type and deflection required for each piece of mechanical equipment.
3. Conform to the requirements of the most current edition of American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Handbook, Sound and Vibration Control.

1.2 QUALITY ASSURANCE

A. Codes: At a minimum, conform to the most current edition of ASHRAE Handbook.

B. Manufacturer: Isolators of the same type shall be the product of the same manufacturer. The manufacturer shall publish and maintain a full line of materials, engineering and application data and operating and maintenance instructions.

1.3 SUBMITTALS

A. Contractor's Certification: Vibration isolator submittals shall include a certification, signed by an officer representing the Contractor and stipulating that the submittal prepared by the manufacturer has been reviewed, and checked on an item by item basis against each piece of mechanical equipment, shown or specified in the Contract Documents, which requires vibration isolation.

B. Manufacturer's Certification: The manufacturer or manufacturers (if there are more than one) shall each certify that the selections of vibration isolation equipment are based upon the drawings and specifications, and that each piece of mechanical equipment has been examined for rotational speed, equipment type, mounting location, and supporting span between column centers, and that an appropriate isolator has been selected.

C. Product Data: Furnish manufacturer's product data covering each isolator type for style, characteristic, and finish.

1. Isolator quantities, dimensions, deflections, capacities and types shall remain the responsibility of the manufacturer and the Contractor.

D. Shop Drawings: Where coordinated shop drawings are required, provide layout drawings, drawn to a scale of not less than 1/4-inch to 1-foot (6 mm to 300 mm), showing the proposed layout of equipment and piping systems and the location and type of each vibration isolation device.

1. Carefully examine other sections requiring coordinated shop drawings and prepare isolation shop drawings to the same scale showing the location of each vibration isolation equipment base, pipe hanger, flexible connection, and isolator.

1.4 STORAGE AND PROTECTION

A. Storage: Store vibration isolation equipment indoors in the manufacturer's original shipping containers. Preclude the entrance of construction dirt and debris.

1. Vibration isolation equipment and bases, which show signs of rust, cement or concrete fouling, dirt and construction debris shall be disassembled and cleaned, approved or removed from the project site and replaced with new.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Mason
2. Vibration Eliminator Co.
3. Kinetics Noise Control

2.2 EQUIPMENT

A. Dimensions: The schedule shows dimensions for deflection and sizes all in inches.

B. Spans: Where referenced, the schedule shows spans of the longest bay dimension for slabs or beams supported between columns. Dimensions are in feet.

C. Selection: Exact mounting sizes, dimensions and quantity of isolators and static deflection required shall be determined by the isolator manufacturer based upon equipment that will be furnished and installed by the Contractor under this Contract.

1. Vibration isolation specialist shall coordinate his work with that of other trades to verify that equipment speeds, in revolutions per minute (rpm), are based upon actual equipment installed at the project site.
2. Verify that equipment rpm and spring deflection selected are arranged so that resonance is avoided.

2.3 ISOLATOR TYPES

A. Type 1 Isolators: Provide pad type vibration isolators consisting of either two layers of 3/8-inch (10 mm) thick elastomer, molded to contain a pattern with non-slip characteristics in all directions, and bonded to 16 gauge (1.6 mm) galvanized steel separator plates, or 1-inch (25 mm) thick precompressed molded fiberglass isolation pads. Minimum overall thickness shall be 1-inch (25 mm). Deflection shall be limited to 0.25 inches (6 mm) or less. Loading shall not exceed 40 pounds per square inch (280 kPa).

B. Type 2I Isolators: Provide double rubber-in-shear or elastomer-in-shear with molded-in steel reinforcement in the top and bottom portions.

1. Deflections shall be limited to 0.5 inches (13 mm) or less.
2. Steel bases shall be drilled with mounting holes and equipment mounting points shall be threaded male or female connections.
3. Treat resilient material with antiozone and antioxidant additives.

C. Type 2H Hangers: Provide rubber-in-compression suspension hangers, consisting of a formed steel frame and elastomer isolation element and provided with attachments for top and bottom suspension rods.

1. Design for a minimum 200 percent overload without noticeable deformation or failure.
2. Metal components shall be galvanized or factory painted.

D. Type 3I Isolators: Provide adjustable, freestanding, open spring isolators with combination leveling and equipment fastening bases.

1. Spring elements shall be contained in upper and lower housing assemblies and shall have a minimum Kx-Ky of 0.75.
2. Design springs for a minimum travel of 50 percent beyond the rated load.

3. When fully compressed and "bottomed-out", isolators shall be capable of supporting a 150 percent overload without deformation and spring failure.
4. A minimum 1/4-inch (6 mm) thick non-skid isolation pad shall be bonded to the underside of the base plate.
5. Size base plates to limit floor loading to 100 pounds per square inch (690 kPa).
6. Drill base plates for bolting, as required.
7. Provide means for anchoring the top element of the isolator to rails and equipment.

E. Type 3H Hangers: Provide combination spring and elastomer hangers consisting of a formed steel frame with coil spring and elastomer insert in compression.

1. Design hangers to be capable of supporting a 200 percent overload without noticeable deformation or failure.
2. Design hangers to allow a 30 degree misalignment without binding or a reduction in hanger efficiency.
3. Design hangers for connection to equipment and supporting rods.

F. Type 4 Isolators: Provide vertically restrained, freestanding, laterally stable, open spring type isolators.

1. Design for deflection exceeding 1/2-inch (13 mm).
2. Provide built-in bearing and leveling provisions.
3. Provide a minimum 1/4-inch (6 mm) thick non-slip elastomer vibration absorbing pad bonded to the underside of the isolator base.
4. Outside diameter of each spring shall be equal to or greater than 0.9 times the operating height of the spring under rated load.
5. Provide vertical limit stops to prevent hyperextension due to wind loads or upward movement when the load is removed. Limit stops shall not bind or inhibit spring movement during normal operating ranges.
6. For exterior applications, steel housings shall be hot dipped galvanized and springs shall be neoprene or powder coated.

G. Type 5 Thrust Restraints: Provide spring isolators of an adjustable, freestanding type enclosed within tubular mountings and arranged to be installed in pairs across the discharge of fan flexible connectors.

1. Design restraints to resist the thrust caused by duct internal air pressure.
2. Install restraints on duct systems with an internal static pressure exceeding 3 inches water gauge (750 Pa).
3. Restraints shall have the same deflection as isolators installed under the fans.

2.4 PIPING

A. General: All piping in mechanical equipment rooms and within fifty feet (15 m) of the vibration source shall be isolated from the building structure with flexible vibration isolators.

1. Suspend piping on Type 3H hangers.
2. Floor-mounted piping shall be supported with Type 4 spring isolators with deflections the same as the equipment to which the piping is attached.

B. Reciprocating Equipment: Provide spring type hangers with deflections equal to that of reciprocating equipment, with piping arranged with offset elbows to absorb vibration.

C. Risers: Pipe and duct risers within 100 feet (30 m) of mechanical equipment rooms shall be resiliently anchored to the building structure with Type 1 vibration isolators, near the midpoint of the risers.

1. Risers shall be isolated and supported at each second floor with pairs of Type 3H hangers, having deflections a minimum of five times the anticipated thermal movement at the support point.
2. Risers shall be guided as required with four (4) sets of Type 2I vibration isolators.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manufacturer: All vibration isolation equipment shall be installed in accordance with the manufacturer's recommendations.

B. Manufacturer's Representative: The vibration isolation installation and deflection testing after equipment start-up shall be conducted by a representative of the manufacturer.

3.2 TESTS AND REPORTS

A. Testing: Each vibration isolation device shall be deflection tested. Two (2) copies of a bound report shall be submitted prior to final acceptance. The certification shall include the following:

1. Certify that equipment has been isolated in accordance with Contract Drawings, specifications and submittals.
2. Certify that all minimum specified deflections have been equaled or exceeded.

3.3 ANCHORING

A. Installation: Installation shall comply with manufacturer's published recommendations and shall be installed so that isolators are plumb and are operating at a manner for which they were designed.

1. Unless otherwise specified, all equipment shall be securely bolted to isolators.
2. Indoor vibration isolators need not be attached to the structure unless required by local codes.
3. Isolators installed outdoors shall be attached to building structure.

3.4 CLEANING

A. Debris: Remove all debris from under equipment, and thoroughly clean steel bases, inertia bases and check for free movement.

B. Adjustment: Adjust isolators as required for proper operation prior to starting equipment. Testing of vibration isolators shall be performed by a certified representative of the manufacturer as specified.

3.5 GENERAL

A. All exterior structural steel and/or steel housings of exterior vibration isolation materials shall be hot dipped galvanized.

END OF SECTION 22 05 48

SECTION 22 05 49

SEISMIC AND WIND CONTROLS – PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section specifies the minimum requirements for restraining Plumbing systems and equipment.

B. The requirements of this section must be coordinated with the requirements of Division-22 section, Vibration Isolation for Plumbing Piping and Equipment.

C. This Section includes the following:

1. Restrained elastomeric isolation mounts
2. Restrained spring isolators
3. Restrained vibration isolation roof curb/rail assemblies
4. Restraint snubbers
5. Restraining braces and cables
6. Flexible connectors for restraint applications

1.3 APPLICABLE STANDARDS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

D. ASCE-7: Minimum Design Loads for Buildings and Other Structures.

1.4 PERFORMANCE REQUIREMENTS

A. All components mounted outside of the building structure shall be mounted to resist minimum wind loads per IBC requirements.

B. Wind-Restraint Loading:

1. Basic Wind Speed: See Structural Drawing General Notes.
2. Building Classification Category: See Structural Drawing General Notes.

3. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

C. All Plumbing components shall be mounted to resist seismic loads per IBC requirements.

D. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: See Structural Drawing General Notes.
2. Assigned Seismic Building Occupancy Category as Defined in the IBC: See Structural Drawing General Notes.

a. Component Importance Factor: See Schedule in Part 3 of this Section.
b. Component Response Modification Factor: Per ASCE-7 Table 13.6-1.
c. Component Amplification Factor: Per ASCE-7 Table 13.6-1.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): See Structural Drawing General Notes.
4. Design Spectral Response Acceleration at 1.0-Second Period: See Structural Drawing General Notes.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of restraint component used.

B. Delegated-Design Submittal: For restraint details indicated to comply with performance requirements and design criteria, include project specific load analysis data signed and sealed by the qualified professional engineer responsible for their preparations.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation and seismic and wind forces required to select restraints.
2. Seismic and Wind Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic and/or wind restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic and/or wind load events. Indicate association with vibration isolation devices.

c. Coordinate seismic and/or wind restraint details required for equipment mounted outdoors. Comply with requirements in other Division-22 Sections for equipment and components mounted outdoors.

d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES showing maximum ratings for concrete anchors (tests or calculations).

C. Coordination Drawings: Show coordination of seismic and/or wind load bracing for Plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and seismic and/or wind restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer.

F. Field quality-control inspection reports.

1.6 QUALITY ASSURANCE

A. Comply with seismic and wind restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Restraint devices shall have horizontal and vertical load analysis and shall bear anchorage preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum restraint ratings. Submittals based on independent testing and/or calculations are acceptable. Calculations (including combining shear and tensile loads) to support restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements of this section, provide products by Kinetics Noise Control or equivalent.

B. Provide appropriate product(s) from those listed below to meet the requirements of restraining or restraining/vibration isolating Plumbing components.

2.2 COMBINATION RESTRAINT/VIBRATION ISOLATION DEVICES FOR NON-CURB MOUNTED EQUIPMENT

A. Restrained Rubber/Neoprene Mounts, Model RQ: All-directional restrained mountings.

1. Materials: Cast-ductile-iron or welded steel housing containing oil-resistant rubber or neoprene elements that prevent central threaded

element and attachment hardware from contacting the housing during normal operation.

B. Restrained Spring Isolators, Model FHS: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 150 percent of rated load, fully compressed, without deformation or failure.
5. Housing: Factory drilled for bolting to structure

C. Restrained Spring Isolators, Models FLS / FLSS: Freestanding, steel, open-spring isolators with limit-stop/restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 150 percent of rated load, fully compressed, without deformation or failure.

D. Side Mount Restrained Spring Isolator, Model FMS: Side mount spring isolator with integral restraint snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional restraint.
2. Base: Factory drilled for bolting to structure.
3. Equipment Mount: Factory drilled for bolting to the equipment.
4. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.
5. Overload Capacity: Support 150 percent of rated load, fully compressed, without deformation or failure.

2.3 COMBINATION RESTRAINT/VIBRATION ISOLATION DEVICES FOR CURB MOUNTED EQUIPMENT

A. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb and rail designed to resiliently support equipment and to withstand seismic and wind forces.

1. All of the components within the final product and including the final product are to be manufactured within the United States of America.
2. Complete curb and isolation assembly shall be stamped by a Professional Engineer licensed in the jurisdiction of the project.
3. Provide sloped and/or extended height curb assemblies as necessary to coordinate with roof slope and buildup.

B. Sheet Metal Restraint/Spring Isolation Curbs, Model KSCR: Upper frame shall consist of extruded aluminum top rail, shall provide continuous support for equipment, and shall be captive to resiliently resist seismic and wind forces. Lower support assembly to be constructed out of formed heavy gage sheet metal, shall have a means for attaching to building structure, contain a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches (50 mm) of rigid, glass-fiber insulation on inside of assembly.

C. Structural Steel Restraint/Spring Isolation Curbs, Model ESR: Upper frame shall consist of a structural steel C channel to provide continuous support for the equipment and provide a place of attachment to the equipment. The lower frame shall be constructed from structural steel and shall provide adequate support to resist seismic and wind loads. The springs shall be adjustable, restrained with 1/4-inch (6-mm) thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic/wind restraint.

    a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
    b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
    c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
    d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
    e. Overload Capacity: Support 150 percent of rated load, fully compressed, without deformation or failure.

2. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

    a. Resilient Material: Oil- and water-resistant hermetically sealed compressed fiberglass.

3. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch (6 mm) thick.
4. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.
5. Extend height of curb as necessary to allow for spring isolator access after roof buildup is installed.

2.4 FLEXIBLE CONNECTORS TO ACCOMMODATE DIFFERENTIAL MOTION

A. Basis-of-Design Product: Subject to compliance with requirements of this section, provide flexible connectors to accommodate differential motion by Engineered Flexible Products (EFP) or equivalent.

B. General Requirements for Flexible Connectors to Accommodate Differential Motion:

1. Flexible connectors shall be chosen to accommodate differential motion caused where piping crosses seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.
2. Flexible connectors shall not introduce any thrust loads into the distribution system and shall contain a welded on braid.
3. Flexible connectors shall be constructed of stainless steel braid with carbon steel end fittings and/or bronze braid with copper end fittings.
4. Flexible connectors shall be V-shaped and capable of accommodating up to 4 inches (100 mm) of differential motion from centerline.
5. Flexible connectors shall be supplied by restraint supplier as part of restraint system.

2.5 SEISMIC AND WIND RESTRAINT DEVICES

A. General Requirements for Concrete Anchoring Components:

1. Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.
2. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be per IBC.

B. Snubbers, Model KSMS / KSMG: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismically rated, with an ICC-ES report.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.

C. Cable Restraint Kit, Model KSCU, KSWC, or KSCC: A pair of pre-stretched steel cables with end connections made of steel assemblies with thimbles (if vibration isolation is needed), brackets, swivels, and bolts designed for restraining cable service.

1. Kit shall include all hardware required for connection to the equipment/system.
2. Kit shall include a tool-less connector to avoid cable cutting and saddle clamps where possible.
3. Cables shall have one end pre-swaged from the manufacturer.
4. Cable size shall be 2 mm, 3 mm, 5 mm, and/or 6 mm in diameter depending on calculated design load.

5. Building and equipment attachment brackets at each end of the cable shall be designed to permit free cable movement in all directions up to a 45-degree misalignment. Protective thimbles shall be used at sharp connection points as required to eliminate potential for dynamic cable wear and strand breakage.

D. Hanger Rod Stiffener, Model KHRC: Clamp for attaching reinforcing steel angle to hanger rod.

E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

G. Resilient Isolation Washers and Bushings, Model TG: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

H. Mechanical Anchor Bolts, Model KCAB/KCCAB/KUAB: Select anchor bolts with strength required for anchorage and as tested according to ASTM E 488. Minimum length of anchor to be eight times diameter.

1. Anchor bolts to be zinc-coated steel for interior applications and stainless steel for exterior applications.
2. For equipment that is rigidly mounted and has 10 horsepower or less use drilled-in and stud-wedge or female-wedge type anchor.
3. For equipment that is rigidly mounted and has greater than 10 horsepower, use undercut anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved by Professional Engineer of record for the project.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on delegated design drawings to receive them and where required to prevent buckling of hanger rods due to seismic and/or wind load forces.

C. Strength of Support and Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic and/or wind loads within specified loading limits.

3.3 SEISMIC AND WIND RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in architectural specifications for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install restraint snubbers on equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Combination restraint/vibration isolation devices may be installed in lieu of separate vibration isolators and restraint snubbers if they conform to all requirements of this specification and Division-22 Section, Vibration Isolation for Plumbing Piping and Equipment.
3. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
4. Install restraint devices using methods provided by restraint supplier and required submittals for component.

C. Piping Restraints:

1. Comply with requirements of restraint system manufacturer.

D. Piping Riser Restraints:

1. Comply with requirements in SMACNA.
2. Restrain per sections 3.3.A and 3.3.B.

E. Install cables so they do not bend across edges of adjacent equipment or building structure.

F. Install restraint devices using methods approved by the restraint supplier required by the submittals for the component.

G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges/webs of beams, at upper truss chords of bar joists, or at concrete members.

J. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

B. Flexible connections to be supplied by restraint supplier.

3.5 FIELD QUALITY CONTROL

A. Inspections:

1. Verify isolator restraint clearance.
2. Verify snubber minimum clearances.
3. Verify ten percent of all cable restraints to ensure the angle of the restraints is installed properly.
4. Verify ten percent of all hanger rod locations where hanger rod stiffening is indicated in coordination drawings to ensure hanger rod stiffeners are installed properly.

3.6 ADJUSTING

A. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

B. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 SEISMIC-RESTRAINT DEVICE SCHEDULE

A. See chart below for component importance factor.

ITEM	IMPORTANCE FACTOR
PUMPS – INLINE	1.5
DOMESTIC WATER HEATERS	1.5
EXPANSION TANKS	1.5
HEAT EXCHANGERS	1.5

END OF SECTION 22 05 49

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of plumbing identification work required by this section is indicated on drawings and/or specified in other Division-22 sections.

B. Types of identification devices specified in this section include the following:

1. Pipe Markers
2. Painted Identification Materials
3. Underground-Type Plastic Line Marker
4. Valve Tags
5. Valve Schedule Frames
6. Engraved Plastic-Laminate Signs
7. Plastic Equipment Markers
8. Plasticized Tags

C. Plumbing identification furnished as part of factory-fabricated equipment, is specified as part of equipment assembly in other Division-22 sections.

D. Refer to other Division-22 sections for identification requirements at central-station mechanical control center; not work of this section.

E. Refer to Division-26 sections for identification requirements of electrical work; not work of this section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. ANSI Standards: Comply with ANSI A13.1 or Owner standards for lettering size, length of color field, colors, and viewing angles of identification devices.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" (213 mm X 275 mm) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve

(room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals.

C. Maintenance Data: Include product data and schedules in maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers' products which may be incorporated in the work include the following:

1. Brady
2. Seton
3. Pipe Marker

2.2 PLUMBING IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-22 sections. Where more than single type is specified for application, selection is Installer's option but provide single selection for each product category.

2.3 PIPE MARKERS

A. Semi rigid Plastic Labels: Provide color-coded, pre-rolled, semi-rigid plastic labels. This type shall be applied to all exposed and concealed piping above ceilings. Labels shall have minimum 3/4" high black letters for pipes 1” and larger, and 1/2" high black letters for pipes smaller pipes. conforming to ANSI A13.1. All labels shall have flow arrows. Prefabricated color bands shall be minimum two (2) inches wide. Markings shall be plain block letters, one (1) inch high on pipes three (3) inches and smaller, and two (2) inches high on pipes over three (3) inches.

B. Color coding shall be in accordance with ANSI A13.1-2007 standards. Refer to Part 3 – Execution for color coding and stencil designation.

2.4 PAINTED IDENTIFICATION MATERIALS

A. Piping and Equipment Systems: Continuous color coded painting of piping and equipment shall be provided in all mechanical rooms in compliance with ANSI A13.1.

2.5 UNDERGROUND-TYPE PLASTIC LINE MARKER

A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" (150 mm) wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.

1. Provide multi-ply tape consisting of solid aluminum foil core between two layers of plastic tape.

2.6 VALVE TAGS

A. Brass Valve Tags: Provide 19-gage (1.2 mm) polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" (6 mm) high letters and sequenced valve numbers 1/2" (13 mm) high, and with 5/32" (4 mm) hole for fastener.

1. Provide minimum 1" (25 mm) diameter tags, except as otherwise indicated.

B. Valve Tag Fasteners: Provide stainless steel beaded chain for proper attachment of tags to valves, and manufactured specifically for that purpose. Valve tag numbers shall be indicated on the As-Built drawings and schematic diagram.

2.7 VALVE SCHEDULE FRAMES

A. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with lexan or glass.

1. Provide valve schedule frames indicating valve type, size, manufacturer and service in each Mechanical Room and/or Custodian Office as directed by Engineer. Provide schedule to Owner framed in rigid plastic frame with rigid plastic glazing.

2.8 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

1. Thickness: 1/16" (1.6 mm) for units up to 20 sq. in. (12900 mm^2) or 8" (200 mm) length; 1/8" for larger units.

B. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

C. Duty: Accident-prevention tags with appropriate wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

2.9 PLASTIC EQUIPMENT MARKERS

A. General: Provide manufacturer's standard laminated plastic, color coded equipment markers.

B. Nomenclature: Include the following, matching terminology on schedules as closely as possible:

1. Name and schedule number
2. Equipment service

2.10 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in plumbing identification work with corresponding designations shown on plans. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of plumbing systems and equipment.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.

B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) exterior non-concealed, locations, and concealed gas piping.

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
4. At access doors, manholes and similar access points which permit view of concealed piping.
5. Within six (6) feet of major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing of 20 feet (6000 mm) along each piping run, and with one (1) label on each pipe in rooms smaller than fifteen (15) feet.

a. Space fire main, standpipe, and fire sprinkler main markers at intervals not exceeding 10' (3 m) on straight pipe runs unless pipe is painted red throughout.

C. Gas Pipe: Paint exposed gas pipe throughout (except chromium plated).

3.3 UNDERGROUND PIPING IDENTIFICATION

A. General: During back-filling/top-soiling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" (150 to 200 mm) below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16" (400 mm), install single line marker.

3.4 VALVE IDENTIFICATION

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, shut-off valves at plumbing fixtures, and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

1. Tagging Schedule: Comply with requirements of "Valve Schedule" of this section.
2. Fire protection valves (shutoff, test, drain, etc. shall be labeled with a rigid plastic identification sign, secured with corrosion-resistant wire or chain, per NFPA 13.

3.5 PLUMBING EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign on or near each major item of plumbing equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
2. Fuel-burning units.
3. Pumps, compressors and similar motor driven units.
4. Heat exchangers, heat recovery units and similar equipment.
5. Fire protection valves, as hereinbefore specified.
6. Tanks and pressure vessels.
7. Water treatment systems and similar equipment.

B. Lettering Size: Minimum 1/4" (6 mm) lettering for name of unit where viewing distance is less than 2'- 0" (600 mm-0 mm), 1/2" (13 mm) high for distances up to 6'- 0" (1800 mm-0 mm), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principle lettering.

C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate

safety and emergency precautions, and warn of hazards and improper operations.

3.6 ADJUSTING AND CLEANING

A. Adjusting: Relocate any plumbing identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.7 EXTRA STOCK

A. Furnish minimum of 5% extra stock of each plumbing identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

3.8 IDENTIFICATION SCHEDULE

A. Contractor shall furnish “Color Charts”, listing piping systems service, color by name and a color sample for each piping service listed below. These charts shall be furnished in a wood frame with glass suitable for hanging in Mechanical Room(s).

SERVICE	DESIGNATION	COLOR
Cold Water	DOMESTIC COLD WATER	Green
Hot Water	DOMESTIC HOT WATER	Yellow
Hot Water Recirculating	HOT WATER RECIRCULATING	Yellow
Fire Protection	FIRE	Red
Sprinkler	SPRINKLER	Red
Gas	GAS (___ PSIG)	Yellow
Compressed Air	AIR (___ psi)	Yellow
Vacuum	VACUUM	Yellow
Sanitary	SANITARY	Green
Vent	VENT	Green
Storm Water	STORM WATER	Green
Condensate Drain	A/C CONDENSATE	Green
Pumped Discharge	PUMPED DISCHARGE	Green

END OF SECTION 22 05 53

SECTION 22 07 00

PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of mechanical insulation specified in this section include the following:

1. Piping System Insulation:

a. Fiberglass

2. Equipment Insulation:

a. Fiberglass

C. Refer to all other Division-22 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firms with at least five (5) years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories, and intended use for each mechanical system requiring insulation.

B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following:

1. Owens Corning
2. Johns Manville
3. Certainteed
4. Armacell
5. Knauf

2.2 PIPE INSULATION MATERIALS

A. Fiberglass Pipe Insulation: ASTM C 547-00, Type 1 (up to 850°F) (up to 454°C), maximum k-value of 0.23 BTU-in/hr-ft^2-deg F at a mean temperature of 75°F.

B. Jackets for Piping Insulation: Jacket assembly shall be ASTM C 1136, Type I with vapor retarder (0.02 perms).

1. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
2. Encase exterior piping insulation with 26 gauge embossed aluminum jacket with weather-proof construction.

C. Bands, Wires and Cement: As recommended by insulation manufacturer for applications indicated.

D. Adhesives, Sealer, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

2.3 EQUIPMENT INSULATION MATERIALS

A. Rigid Fiberglass Equipment Insulation: ASTM C 612-00, Type 1A (up to 450°F) (up to 232°C).

B. Jacketing Material for Equipment Insulation: Provide 8 ounce (227 g) canvas or pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard (263 g/m^2), or metal jacket at Installer's option, except as otherwise indicated.

C. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

D. Equipment Insulation Accessories: Provide bands, wire, wire netting, tape corner angles, anchors, stud pins as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 PLUMBING PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, fire protection piping, preinsulated equipment and air conditioning condensate drain piping in mechanical rooms and/or on roof.

B. Cold Piping:

1. Application Requirements: Insulate the following cold plumbing piping systems:

   a. Potable cold water piping.
   b. Interior above-ground horizontal storm water piping and roof drain sumps.
   c. Interior above-ground horizontal sanitary piping.
   d. Plumbing vents within 6 linear feet (1800 mm) of roof outlet.
   e. Make-up water piping.
   f. Air conditioning condensate drain piping.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

   a. Fiberglass: 1" (25 mm) thickness.

C. Hot Piping:

1. Application Requirements: Insulate the following hot plumbing piping systems:

   a. Potable hot water piping.
   b. Potable hot water recirculating piping.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

a. Fiberglass: 1-1/2" (40 mm) thick.

Note: Insulation provided for domestic hot water applications shall have a minimum R-value of 6.0.

3.3 EQUIPMENT INSULATION

A. Hot Equipment (Above Ambient Temperature):

1. Application Requirements: Insulate the following hot equipment:

a. Hot water storage tanks
b. Heat exchangers
c. Metal flue outlet of each water heater

2. Insulate each item of equipment specified above with the following type and thickness of insulation:

a. Rigid Fiberglass: 2" (50 mm) thick, except 3" (75 mm) thick for steam-jacketed heat exchangers.

B. Breeching and Stack Insulation:

1. Application Requirements: Insulate the following breechings and stacks:

a. Breechings between heating equipment outlet and stack or chimney connection, except for double wall or factory insulated breechings.
b. Stacks from bottom to top except for factory insulated stacks.

3.4 INSTALLATION OF PIPING INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

1. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet pressure testing requirements indicated throughout these specifications.

B. Install insulation on pipe systems subsequent to installation of heat tracing, testing, and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage. Staples shall not be used.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Provide factory molded insulation for all valves, fittings, unions, etc. Valve handles must be extended by the mechanical contractor to accommodate the insulation without reducing the thickness or integrity of the valve insulation.

G. Extend piping insulation without interruption through pipe hangers, walls, floors and similar piping penetrations, except where otherwise indicated.

H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" (75 mm) wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" (75 mm) wide vapor barrier tape or band.

I. All exposed pipe insulation, including fittings, above 8'- 0" (2400 mm-0 mm) of finished floor shall have 8 oz. (227 g) fire retardant canvas cover neatly cut and parted seams shall be sealed.

J. All exposed pipe insulation, including fittings, within 8' - 0" (2400 mm-0 mm) of finished floor or within a stairwell, shall be provided with aluminum or PVC protective covers. All edges shall be hemmed and all seams shall be concealed.

K. All exterior piping shall be provided with an embossed aluminum jacket.

L. For all insulated piping 2-1/2” (63 mm) and larger, provide insulated pipe saddles as follows:

1. For domestic hot and cold water piping (up to 250ºF), provide the following:

a. Minimum 3.75 pcf, non-compressive, rigid, phenolic foam insulation. Fire and smoke rating shall be 25/50 or below per ASTM 84.
b. For cold applications below 75ºF (24ºC) a zero permeability, abuse resistant, vapor barrier shall be provided with matching butt strips. Apply a full coating of butyl joint sealant in addition to the butt strips for a completely sealed system.
c. The phenolic foam system shall have a K factor of 0.16 at a mean temperature for 75ºF (24ºC) and comply with ASTM Standard C1126.
d. Provide visible inspection sticker at the bottom of each saddle.
e. Pipe insulation saddles shall be Tru-Balance CoolDry Saddles as manufactured by Buckaroos, Inc. or equivalent.

3.5 INSTALLATION OF EQUIPMENT INSULATION

A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

1. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet pressure testing requirements indicated throughout these specifications.
2. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.
3. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
4. Do not apply insulation to equipment, breechings, or stacks while hot.
5. Apply insulation using staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.
6. Coat insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.
7. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2" (50 mm). Apply over vapor barrier where applicable.
8. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

B. Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by manufacturer.

3.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division-22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping installer for piping insulation application and equipment installer for equipment insulation application. Before preparing piping shop drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

3.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

3.8 EXISTING INSULATION REPAIR/REPLACEMENT

A. Repair damaged sections of existing mechanical and plumbing insulation, either previously damaged or damaged during this construction period. Insulation shall be as specified herein.

B. Provide new insulation on existing mechanical and plumbing piping where existing insulation has been removed due to damage, repair or abatement of existing hazardous materials.

3.9 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 22 07 00

SECTION 22 11 13

FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for combined water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of Baltimore County. Include tapping of water mains and backflow prevention.
2. Comply with standards of Baltimore County for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of Baltimore County for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to Baltimore County, and marked for intended use.

D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

F. NSF Compliance:

1. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Owner's permission.

1.9 COORDINATION

A. Coordinate connection to existing water main with Baltimore County department of water and sewer.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.

1. Copper, Pressure-Seal Fittings:

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Viega; Plumbing & Heating Systems.

c. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
d. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

B. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

C. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

B. Flanges: ASME 16.1, Class 125, cast iron.

2.3 SPECIAL PIPE FITTINGS

A. Ductile-Iron Deflection Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. EBAA Iron, Inc.

3. Description: Compound, ductile-iron coupling fitting with sleeve and 1 or 2 flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

a. Pressure Rating: 250 psig minimum.

2.4 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Subject to compliance with Baltimore County requirements, provide the product indicated on drawings.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Subject to compliance with Baltimore County requirements, provide the product indicated on Drawings

2. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.
b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, [metal] [resilient]-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Provide the product indicated on drawings.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.6 WATER METERS

A. Water meters are obtained by applying to the Baltimore County Department of Permits and Development Management.

2.7 WATER METER BOXES

A. Provide the product indicated on drawings.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 23 shall be the following:

1. Soft copper tube, ASTM B 88, Type K copper, pressure-seal fittings; and pressure-sealed joints.

F. Underground water-service piping NPS 4 to NPS 8 shall be the following:

1. Ductile-iron, push-on-joint fittings; and gasketed joints.

G. Water Meter Box Water-Service Piping NPS 2 shall be same as underground water-service piping.

H. Underground Fire-Service-Main Piping NPS 4 shall be the following:

1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used.

3.4 PIPING INSTALLATION

A. Water-Main Connection: Arrange with Baltimore County for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of Baltimore County and of size and in location indicated.

C. Comply with NFPA 24 for fire-service-main piping materials and installation.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

D. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

E. Bury piping with depth of cover over top at least 48 inches with top at least 12 inches below level of maximum frost penetration.

F. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use thrust blocks, anchors and other supports.

H. See Section 211200 "Fire-Suppression Standpipes," Section 211313 "Wet-Pipe Sprinkler Systems," and Section 211316 "Dry-Pipe Sprinkler Systems" for fire-suppression-water piping inside the building.

I. See Section 221116 "Domestic Water Piping" for potable-water piping inside the building.

3.5 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Bolted flanged joints.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.6 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

3.7 WATER METER INSTALLATION

A. Install water piping, and specialties according to Baltimore County's written instructions.

3.8 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to Baltimore County's written instructions.

3.9 CONNECTIONS

A. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve. See construction documents or Baltimore County department of public works standard details.

B. Connect water-distribution piping to interior domestic water and fire-suppression] piping as indicated on plumbing drawings.

3.10 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.11 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

3.12 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 22 11 13

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of domestic water piping systems work is indicated on drawings and schedules, and by requirements of this section.

B. Applications for domestic water piping systems include the following:

1. Domestic cold-water piping
2. Domestic hot-water piping
3. Domestic recirculating-water piping
4. Exterior water piping
5. Make-up water piping

C. Refer to appropriate Division-22 sections for insulation required in connection with domestic water piping; not work of this section.

D. Refer to appropriate Division-2 sections for trenching and backfill required in conjunction with exterior water piping; not work of this section.

E. Trenching and backfill required in conjunction with domestic water piping inside of building foundations is specified in applicable Division-2 and Division-22 sections, and is included as work of this section.

F. Refer to other Division-22 sections for water treatment, (sterilization) not work of this section.

1.2 QUALITY ASSURANCE

A. Qualification of Installers: The entire system shall be installed by trained workmen skilled in the installation of such systems.

B. Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code and all other applicable codes and/or Owner's requirements pertaining to plumbing materials, construction and installation of products.

C. ANSI and ASTM Compliance: Comply with applicable standards pertaining to products and installation of domestic water piping systems.

D. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data for domestic water piping systems, materials and products.

B. Shop Drawings: Submit scaled layout drawings as required by Division-22 Section “Basic Plumbing Requirements”.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in domestic water piping systems. Where more than one type of materials or products is indicated, selection is Installer's option.

2.2 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-22 Section "Identification for Plumbing Piping and Equipment".

2.3 BASIC PIPE, TUBE, AND FITTINGS

A. General: Provide pipe, tube, and fittings complying with Division-22 Section "Pipe, Tube, and Fittings for Plumbing Systems", in accordance with the following listing:

B. Domestic Hot Water Piping:

1. All sizes: Copper tube.

a. Wall Thickness: Type L, hard-drawn temper.
b. Fittings: Wrought-copper, solder-joints.

C. Interior Domestic Cold Water Piping:

1. Tube Size 2" (50 mm) and Smaller: Copper tube.

a. Wall Thickness: Type L, hard-drawn temper.
b. Fittings: Wrought-copper, solder-joints.

2. Pipe Size 2-1/2" (65 mm) and Larger: Galvanized steel pipe.

a. Pipe Weight: Schedule 40.
b. Fittings: Screwed type.

D. Exterior and Below Grade Cold Water Piping:

1. Tube Size 2" (50 mm) and Smaller: Copper tube.
   a. Wall Thickness: Type K, soft-annealed temper.
   b. Fittings: Wrought-copper, solder-joints.

2. Pipe Size 2-1/2" (65 mm) and Over: Ductile-iron pipe, with cement-mortar lining.

   a. Pipe Weight: Schedule 150.
   b. Fittings: Ductile-iron, with rubber-gasket joints.

E. Cold Water Piping to Trap Primers: Type M copper tubing.

2.4 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division-22 Section "Piping Specialties for Plumbing Systems", in accordance with the following listing:

1. Pipe escutcheons
2. Low-pressure Y-type pipeline strainers
3. Dielectric fittings
4. Drip pans
5. Pipe sleeves
6. Sleeve seals

2.5 SPECIAL PIPING SPECIALTIES

A. Water Hammer Arresters: Provide bellows type water hammer arresters, stainless steel casing and bellows, pressure rated for 250 psi (1725 kPa), tested and certified in accordance with PDI Standard WH-201.

B. Hose Connection Vacuum Breakers: Provide hose connection vacuum breakers where indicated for back-siphonage protection.

1. Brass construction, suitable for indoor or outdoor use (maximum pressure 125 psi) (maximum pressure 1725 kPa).
2. Inlet shall be 3/4" (20 mm) standard female hose thread; outlets shall be 3/4" (20 mm) male hose thread.
3. Provide non-removable feature to prevent unauthorized removal from pipe system or sill cock.

2.6 BASIC SUPPORTS AND ANCHORS

A. General: Provide supports, anchors, and seals complying with Division-22 Section "Hangers and Supports for Plumbing Piping and Equipment", in accordance with the following listing:

1. Adjustable steel clevises, adjustable roller hangers, and adjustable pipe roll stands for horizontal piping hangers and supports.
2. Two-bolt riser clamps for vertical piping supports.
3. Concrete inserts, C-clamps, and steel brackets for building attachments.

4. Protection saddles for insulated piping support in hangers.
5. Copper flashings for piping penetrations.

2.7 BASIC VALVES

A. General: Provide valves complying with Division-22 Section "Valves for Plumbing Piping", in accordance with the following listing:

1. Sectional Valves:

a. 2" (50 mm) and Smaller: Ball Valves.
b. 2-1/2" (65 mm) and Larger: Butterfly Valves.

2. Shutoff Valves:

a. 2" (50 mm) and Smaller: Ball Valves.
b. 2-1/2" (65 mm) and Larger: Butterfly Valves.

3. Drain Valves:

a. 2" (50 mm) and Smaller: Ball Valves.

4. Incoming Water Service:

a. All Sizes: OS&Y Gate Valves.

5. Check Valves:

a. All Sizes: Swing Check Valves.

2.8 SPECIAL VALVES

A. General: Special valves required for domestic water piping systems include the following types:

1. Balance Cocks:

a. Soldered Ends 2" (50 mm) and Smaller: Class 125, bronze body, bronze plug, screw driver operated, straight or angle pattern.

2. Hydrants:

a. Recessed Non-Freeze Wall Hydrants: Cast-bronze box hydrant, polished bronze face plate, tee handle key, bronze casing, length to suit wall thickness, vacuum breaker, hinged locking cover, 3/4" (20 mm) inlet, hose outlet.
b. Non-Freeze Roof Hydrants: Bronze hydrant, tee handle key, bronze casing with cast-iron casing guard, length to suit depth of roof structure, drain hole, vacuum breaker, 3/4" (20 mm) inlet, hose outlet.

2.9 PUMPS

A. General: Provide pumps complying with Division-22 Section "Plumbing Pumps", in accordance with the following listing:

1. Hot water recirculating

2.10 BACKFLOW PREVENTERS (DOMESTIC WATER AND MAKE-UP WATER)

A. General: Provide reduced pressure principle backflow preventers consisting of assembly including shutoff valves on inlet and outlet, and strainer on inlet. Backflow preventers shall include test cocks, and pressure-differential relief valve located between two (2) positive seating check valves. Construct in accordance with ASSE Standard 1013.

B. Backflow preventer size shall not be less than the connected line size indicated.

2.11 PRESSURE REGULATING VALVES

A. General: Provide pressure regulating valves, single seated, direct operated type, bronze body, integral strainer, complying with requirements of ANSI/ASSE Standard 1003. Size for maximum flow rate and inlet and outlet pressures indicated on drawings.

2.12 BASIC EXPANSION COMPENSATION

A. General: Provide expansion compensation products complying with Division-22 Section "Expansion Compensation for Plumbing Piping", in accordance with the following listing:

1. Expansion compensators for hot water and hot water recirculating piping.
2. Pipe alignment guides.

2.13 BASIC METERS AND GAUGES

A. General: Provide meters and gauges complying with Division-22 Section "Meters and Gauges for Plumbing Piping".

PART 3 - EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division-22 Section "Identification for Plumbing Piping and Equipment".

3.2 INSTALLATION OF DOMESTIC WATER DISTRIBUTION PIPING

A. General: Install water distribution piping in accordance with Division-22 Section "Pipe, Tube, and Fittings for Plumbing Systems".

B. Domestic cold water tubing serving trap primers located below floor slab shall be installed in 2" (50 mm) PVC conduit.

3.3 INSTALLATION OF EXTERIOR WATER PIPING

A. General: Install exterior water service piping system in compliance with local governing regulations.

B. Water Service Piping: Extend water service piping of size and in location indicated to water service entrance at building. Provide sleeve in foundation wall for water service entry; make entry watertight. Provide gate valve at water service entry inside building; strainer, pressure gage, test tee with valve.

C. Copper Tube: Install in accordance with recommended procedures of the Copper Development Association.

D. Ductile-Iron Pipe: Install in accordance with ANSI/AWWA C-60.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Division-22 Section "Piping Specialties for Plumbing Systems".

B. Water Hammer Arresters: Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, and elsewhere as indicated.

3.5 INSTALLATION OF SUPPORTS, ANCHORS, AND SEALS

A. Install supports, anchors, and seals in accordance with Division-22 Section "Hangers and Supports for Plumbing Piping and Equipment".

3.6 INSTALLATION OF VALVES

A. Install valves in accordance with Division-22 Section "Valves for Plumbing Piping".

B. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two (2) or more plumbing fixtures or equipment connections, and elsewhere as indicated.

C. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

D. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of

each rise or drop in piping system, and elsewhere where indicated or required to completely drain domestic water piping system.

E. Check Valves: Install on discharge side of each pump, and elsewhere as indicated.

F. Balance Cocks: Install in each hot water recirculating loop, and elsewhere as indicated.

G. Hydrants: Installed where indicated, in accordance with manufacturer's installation instructions.

3.7 INSTALLATION OF PUMPS

A. Install pumps in accordance with Division-22 Section "Plumbing Pumps".

B. Refer to automatic temperature control section for control of hot water recirculating pumps; not work of this section.

C. Provide the following controls for each hot water recirculating pump and provide interface to the building automation system. Refer to Automatic Temperature Control Section; not work of this section.

1. Immersion aquastat to start pump at 110°F (43°C) and stop pump at 120°F (49°C).
2. Seven (7) day time clock and separate on-auto-off switch or interface with BAS scheduling.
3. All relays required for above.

3.8 INSTALLATION OF BACKFLOW PREVENTERS

A. Install backflow preventers where indicated, and where required by National Standard Plumbing Code. Pipe relief outlet to nearest floor drain thru air gap fitting.

3.9 INSTALLATION OF PRESSURE REGULATING VALVES

A. Install pressure regulating valves where required to reduce the pressure below the code allowable pressure. Provide inlet and outlet shutoff valves, and globe valve bypass. Provide pressure gage on valve inlet outlet.

3.10 INSTALLATION OF EXPANSION COMPENSATION PRODUCTS

A. Install expansion compensation products in accordance with Division-22 Section "Expansion Compensation for Plumbing Piping".

3.11 INSTALLATION OF METERS AND GAUGES

A. Install meters and gauges in accordance with Division-22 Section "Meters and Gauges for Plumbing Piping".

3.12 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts of sizes indicated, but in no case smaller than required by National Standard Plumbing Code.

B. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated, and comply with equipment manufacturer's installation instructions. Provide shutoff valve and union for each connection, provide drain valve on drain connection.

3.13 SPARE PARTS

A. Furnish to the Owner, with receipt, one valve key for each key operated hydrant or faucet installed.

END OF SECTION 22 11 16

SECTION 22 11 23

PLUMBING PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of plumbing pumps work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of pumps specified in this section include the following:

1. In-Line Recirculation Pumps
2. Elevator Sump Pumps

C. Refer to other Division-22 sections for insulation of pump housings; not work of this section.

D. Refer to other Division-22 sections for vibration control of plumbing pumps; not work of this section.

E. Provide the following electrical work as work of this section, complying with requirements of Division-26 sections:

1. Control wiring between field-installed controls, indicating devices, and pump control panels.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. HI Compliance: Design, manufacture, and install plumbing pumps in accordance with HI "Hydraulic Institute Standards".
2. UL Compliance: Design, manufacture, and install plumbing pumps in accordance with UL 778 "Motor Operated Water Pumps".
3. UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.
4. SSPMA Compliance: Test and rate sump and sewage pumps in accordance with Sump and Sewage Pump Manufacturer's Association (SSPMA) and provide certified rating seal.
5. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

B. Certification, Pump Performance: Provide pumps whose performances, under specified operating conditions, are certified by manufacturer.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's pump specifications, installation and start-up instructions, and current accurate pump characteristic performance curves with selection points clearly indicated.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to plumbing pumps. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance data and spare parts lists for each type of pump, control, and accessory; including "troubleshooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle plumbing pumps and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged plumbing pumps or components; replace with new.

B. Store plumbing pumps and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with Manufacturer's rigging and installation instructions for unloading plumbing pumps, and moving them to final location.

PART 2 - PRODUCTS

2.1 PUMPS

A. General: Provide factory-tested pumps, thoroughly cleaned, and painted with one coat of machinery enamel prior to shipment. Type, size, and capacity of each pump are listed in pump schedule. Provide pumps of same type by same manufacturer.

2.2 IN-LINE RECIRCULATION PUMPS

A. General: Provide in-line recirculation pumps where indicated, and of capacities as scheduled.

B. Type: Horizontal, oil-lubricated, designed for 125 psi (850 kPa) working pressure, 225°F (107°C) continuous water temperature, and specifically designed for quiet operation.

C. Body: All bronze construction.

D. Shaft: Stainless steel, ground and polished, integral thrust collar.

E. Bearings: Two horizontal sleeve bearings designed to circulate oil.

F. Seal: Mechanical, with carbon seal face rotating against ceramic seat.

G. Motor: Non-overloading at any point on pump curve, open, dripproof, sleeve bearings, quiet operating, rubber mounted construction, built-in thermal overload protection.

H. Coupling: One-piece spring coupling.

2.3 ELEVATOR SUMP PUMPS

A. General: Provide sump pumps in all elevator pits with the capacities as scheduled.

B. Type: Submersible sump pump with a stainless steel oil sensor probe mounted on the pump, 2” discharge, double mechanical seal, cast iron impeller with check valve.

C. Control Panel: Provide control panel in a NEMA 4X fiberglass enclosure with visual and audible alarm, auxiliary contact, overcurrent relay, terminal board, RMS relay, magnetic contactor, alarm silence, pump overload light and horn.

D. Provide junction box with multi-pin connector and power cord of length as required to connect to control panel.

E. Provide Stancor elevator pit sump pump with “Oil Minder” control system or equivalent.

3.1 INSPECTION

A. Examine areas and conditions under which plumbing pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PUMPS

A. General: Install plumbing pumps where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that plumbing pumps comply with requirements and serve intended purposes.

B. Access: Provide access space around plumbing pumps for service as indicated, but in no case less than that recommended by manufacturer.

C. Support: Refer to Division-22 section "Vibration Control for Plumbing Piping and Equipment" for support and mounting requirements of plumbing pumps.

1. Install in-line pumps, supported from piping system.

D. Basins: Install sump pump basins in indicated locations and connect to sewer

inlets. Brace interior of basin in accordance with manufacturer's instructions, to prevent distortion or collapse during concrete placement. Refer to Architectural Division for concrete work; not work of this section. Set cover over basin, fasten to top flange of basin. Install so cover is flush with finished floor.

E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

F. Piping Connections: Refer to Division-22 plumbing piping sections. Provide piping, valves, accessories, gages, supports, and flexible connections as indicated.

3.3 ADJUSTING AND CLEANING

A. Alignment: Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer, and in presence of manufacturer's service representative.

B. Start-up: Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 22 11 23

SECTION 22 13 13

FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Cleanouts.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of pipe and fitting, from manufacturer.

B. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Engineer no fewer than two days in advance of proposed interruption of service.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.2 CLEANOUTS

A. PVC Cleanouts:

1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

C. Install gravity-flow, nonpressure, drainage piping according to the following:
1. Install PVC gravity sewer piping according to ASTM D 2321 and ASTM F 1668.

D. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:
1. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.

2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."

B. Make connections to existing piping and underground manholes.

1. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

2. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. Connect to grease oil and sand interceptors specified in Section 221323 "Sanitary Waste Interceptors."

3.6 IDENTIFICATION

A. Comply with requirements in Section 31200 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use warning tape or detectable warning tape over ferrous piping.

3.7 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.8 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 22 13 13

SECTION 22 13 16

SOIL, WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of soil and waste piping system work is indicated on drawings and schedules, and by requirements of this section.

B. Applications for soil and waste piping systems include the following:

1. Aboveground soil, waste and vent piping within buildings including soil stacks, vent stacks, horizontal branches, traps, and connections to fixtures and drains.
2. Underground building drain piping including mains, branches, traps, connections to fixtures and drains, and connections to stacks, terminating at connection to sanitary sewers five feet outside of foundation wall.

C. Exterior sanitary sewer system is specified in applicable Division-02 sections, and is included as work of this section.

D. Refer to appropriate Division-22 sections for insulation required in connection with soil and waste piping; not work of this section.

E. Trenching and backfilling required in conjunction with underground building drain piping is specified in applicable Division-22 sections, and is included as work of this section.

1.2 QUALITY ASSURANCE

A. Specimen Joints: Before commencing pipe laying, Contractor shall form specimen joints to demonstrate that materials and methods employed will result in watertight joints.

B. Qualification of Installers: The entire system shall be installed by trained workmen skilled in the installation of such systems for a minimum of five (5) years.

C. Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to plumbing materials, construction and installation of products.

D. ANSI Compliance: Comply with applicable American National Standards pertaining to products and installation of soil and waste piping systems.

E. PDI Compliance: Comply with applicable Plumbing and Drainage Institute Standards pertaining to products and installation of soil and waste piping systems.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data for soil and waste piping systems materials and products.

B. Shop Drawings: Submit scaled layout drawings of soil and waste pipe and fittings showing interface and spatial relationship between piping, ductwork and proximate equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cleanouts, drains and valves which may be incorporated in the Work include the following:

1. Josam
2. J. R. Smith
3. Zurn
4. Mifab
5. Wade
6. Watts Drainage

2.2 SOIL, WASTE AND VENT PIPING MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in soil and waste piping systems. Where more than one (1) type of materials or products is indicated, selection is Installer's option.

2.3 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-22 section, “Identification for Plumbing Piping and Equipment”.

2.4 BASIC PIPE, TUBE, AND FITTINGS

A. General: Provide pipe, tube, and fittings complying with Division-22 section "Pipe, Tube, and Fittings for Plumbing Systems", in accordance with the following listing:

B. Above Ground Piping Within Buildings:

1. Tube Size 8" (200 mm) and Smaller: Copper tube.

a. Wall Thickness: Type DWV.
b. Fittings: Cast-bronze, drainage pattern, solder-joint.

2. Pipe Size 15" (400 mm) and Smaller: Cast-iron hub-and-spigot soil pipe.

   a. Pipe and fittings to be service weight and shall comply with ASTM A-74 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISPI).
   b. Fittings: Compression gasket joints meeting the requirements of ASTM C-564, or lead and oakum joints.

3. Pipe Size 15" (400 mm) and Smaller: Hubless cast-iron soil pipe.

   a. Pipe and fittings shall comply with ASTM A-888 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISPI).
   b. Fittings: Hubless couplings shall comply with CISPI Standard 310.
   c. Provide heavy duty shielded couplings for all aboveground piping.
   d. Heavy Duty Shielded Couplings: Heavy duty couplings shall be composed of a corrugated shield with a gauge .015, clamp assembly with a 3/8 inch worm gear tightened to a minimum of 80 inch pounds, a smooth shielded gauge of .025 tightened to 100-125 inch pounds or a cast iron shield tightened to 175 inch pounds and an elastomeric sealing sleeve conforming to ASTM C564. Heavy duty couplings shall be ANACO/Husky SD 4000 or equivalent by Clamp All or MG Couplings.

4. Pipe Size 24" (600 mm) and Smaller: Galvanized steel pipe.

   a. Pipe Weight: Schedule 40.
   b. Fittings: Class 125, galvanized cast-iron, drainage pattern, screwed joints.

C. Underground Building Drain Piping:

1. Pipe Size 15" (400 mm) and Smaller: Cast-iron hub and spigot soil pipe.

   a. Pipe and fittings to be service weight and shall comply with ASTM A-74 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISPI).
   b. Fittings: Compression gasket joints meeting the requirements of ASTM C-564, or lead and oakum joints.

2.5 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division-22 section "Piping Specialties for Plumbing Systems", in accordance with the following listing:

1. Pipe Escutcheons
2. Vandal-Proof Vent Caps
3. Pipe Sleeves
4. Sleeve Seals

2.6 SPECIAL PIPING SPECIALTIES

A. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.

B. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks.

2.7 SUPPORTS AND ANCHORS

A. General: Provide supports and anchors complying with Division-22 sections in accordance with the following listing:

1. Adjustable steel clevises, steel pipe clamps, and pipe saddle supports for horizontal piping hangers and supports.
2. Two-bolt riser clamps for vertical piping supports.
3. Concrete inserts, C-clamps, and steel brackets for building attachments.
4. Copper flashings for piping penetrations.

2.8 SPECIAL VALVES

A. General: Special valves required for soil and waste piping systems include the following types:

1. Backwater Valves: Cast-iron body, bronze backwater valve assembly swing check type, with cleanout access cover. Provide ends to suit piping material; bolted cover.

2.9 SPECIAL EXPANSION COMPENSATION

A. General: Special expansion compensation products required for soil and waste piping systems include the following types:

1. Expansion Joints: Cast-iron body, adjustable bronze sleeve, bronze bolts with wing nuts; for vertical installation only.

2.10 CLEANOUTS

A. General: Provide factory-fabricated drainage piping products of size and type indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and governing regulations.

B. Cleanouts in Piping: Cast-iron cleanout ferrule with bronze countersunk plug, suitable for no-hub applications.

C. Cleanouts in finished walls and partitions shall be similar to cleanouts in piping. Provide round polished stainless steel wall access cover with screw. Finish as per Architect.

D. Cleanouts in Tiled Floor: Cast-iron internal gasketed cleanout plug and adjustable housing with secured scoriated square satin Nikaloy top.

E. Cleanouts in Non-Tiled Floor: Similar to tiled floor type with a secured scoriated round satin Nikaloy top.

2.11 FLOOR DRAINS

A. General: Provide floor drains of size as indicated on drawings; and type, including features, as specified herein:

B. Toilet Room Floor Drain: Cast-iron body and flashing collar, Nikaloy adjustable strainer head with secured square grate, with the following features:

1. Heel-proof grate.
2. 1/2" (13 mm) trap priming connection.
3. Bottom outlet, no-hub for aboveground piping or, bottom outlet, hub and spigot for underground piping.

C. Mechanical Room Floor Drain: Cast-iron body and flashing collar, heavy duty loose set grate (minimum 9" diameter) (minimum 225 mm diameter), with the following features:

1. Double drainage flange with weep holes.
2. Sediment bucket.
3. Adjustable extension.
4. 1/2" (13 mm) trap priming connection.
5. Flat bottom strainer.
6. Deep body.
7. Bottom outlet, no-hub for aboveground piping or, bottom outlet, hub and spigot for underground piping.
8. Provide funnels for drains receiving A/C condensate or elsewhere as indicated.

D. General Purpose Floor Drain: Cast-iron body and flashing collar, Nikaloy adjustable strainer head with secured square grate, with the following features:

1. Sediment bucket.
2. Heel-proof grate.
3. 1/2" (13 mm) trap priming connection.
4. Bottom outlet, no-hub for aboveground piping or, bottom outlet hub and spigot for underground piping.

E. Floor Sink: Rectangular cast-iron with deep acid resistant receptor, less grate with the following features:

1. Acid resistant sediment bucket.
2. 1/2" (13 mm) trap priming connection.

PART 3 - EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division-22 section "Identification for Plumbing Piping and Equipment".

3.2 INSTALLATION OF SOIL AND WASTE ABOVE GROUND PIPING

A. General: Install soil and waste piping in accordance with Division-22 section "Pipe, Tube, and Fittings for Plumbing Systems", and with National Standard Plumbing Code.

3.3 INSTALLATION OF BUILDING DRAIN PIPING

A. General: Install underground building drains as indicated and in accordance with National Standard Plumbing Code. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clean interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Temporarily cover end of uncompleted piping at end of day or whenever work stops.

1. Install soil and vent piping pitched to drain at minimum slope of 1/8" per foot (10 mm per meter) (1%). Where possible 1/4" per foot (20 mm per meter) (2%) shall be provided.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Division-22 section "Piping Specialties for Plumbing Systems".

3.5 INSTALLATION OF SUPPORTS AND ANCHORS

A. Install supports and anchors in accordance with Division-22 section "Hangers and Supports for Plumbing Piping and Equipment".

3.6 INSTALLATION OF SPECIAL VALVES

A. Backwater Valves: Install in sanitary building drain piping serving fixtures located below curb line and as required by National Standard Plumbing Code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover, and of adequate size to remove valve cover for service. Install in such a manner to provide maximum 1/4" (6 mm) clearance between flapper and seat for air circulation.

3.7 INSTALLATION OF SPECIAL EXPANSION COMPENSATION PRODUCTS

A. Expansion Joints: Install expansion joints on vertical risers as indicated, or as required by National Standard Plumbing Code.

3.8 INSTALLATION OF DRAINAGE PIPING PRODUCTS

A. Cleanouts: Install in sanitary above ground piping and sanitary building drain piping as indicated, as required by National Standard Plumbing Code; and at

each change in direction of piping greater than 45 degrees; at minimum intervals of 50 feet (15 m) for piping 4" (100 mm) and smaller and 75 feet (23 m) for larger piping; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.

B. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

C. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.9 INSTALLATION OF FLOOR DRAINS

A. General: Install floor drains in accordance with manufacturer's written instructions and in locations indicated.

1. Coordinate with soil and waste piping as necessary to interface floor drains with drainage piping systems.
2. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.
3. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
4. Position drains so that they are accessible and easy to maintain.

3.10 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by National Standard Plumbing Code.

1. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.11 PIPING TESTS

A. Test soil and waste piping system in accordance with requirements of Division-22 section "Pipe, Tube and Fittings for Plumbing Systems".

END OF SECTION 22 13 16

SECTION 22 14 13

STORM WATER PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of storm water piping work is indicated on drawings and schedules, and by requirements of this section.

B. Applications for storm water piping include the following:

1. Conductor piping from roof drains and deck drains to storm water system.
2. Storm water piping from conductor piping and area drains to storm sewers five feet outside of foundation wall.
3. Air conditioning condensate piping.
4. Sump pump discharge piping.

C. Exterior storm water system is specified in applicable Division-02 sections, and is included as work of this section.

D. Refer to appropriate Division-22 sections for insulation required in conjunction with storm water piping; not work of this section.

E. Trenching and backfill required in conjunction with storm building drain piping is specified in applicable Division-22 sections, and is included as work of this section.

1.2 QUALITY ASSURANCE

A. Specimen Joints: Before commencing pipe laying, Contractor shall form specimen joints to demonstrate that materials and methods employed will result in watertight joints.

B. Qualification of Installers: The entire system shall be installed by trained workmen skilled in the installation of such systems for a minimum of five (5) years.

C. Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to plumbing materials, construction and installation of products.

D. ANSI Compliance: Comply with applicable American National Standards pertaining to products and installation of soil, waste and storm water piping systems.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data for storm water piping systems materials and products.

B. Shop Drawings: Submit scaled layout drawings of installed storm water pipe and fittings showing interface and spatial relationship between piping and proximate equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cleanouts, drains and valves which may be incorporated in the Work include the following:

1. Josam
2. J. R. Smith
3. Zurn
4. Wade
5. Mifab
6. Watts Drainage

2.2 STORM WATER PIPING MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in storm water piping systems. Where more than one type of materials or products is indicated, selection is Installer's option.

2.3 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-22 section "Identification for Plumbing Piping and Equipment".

2.4 BASIC PIPE, TUBE AND FITTINGS

A. General: Provide pipe, tube, and fittings complying with Division-22 section "Pipe, Tube, and Fittings for Plumbing Systems", in accordance with the following listing:

B. Above Ground Piping Within Buildings:

1. Tube Size 8" (200 mm) and Smaller: Copper tube.

a. Wall Thickness: Type DWV.
b. Fittings: Cast-bronze, drainage pattern, solder-joints.

2. Pipe Size 15" (400 mm) and Smaller: Cast-iron hub-and-spigot soil pipe.

   a. Pipe and fittings to be service weight and shall comply with ASTM A-74 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISBI).
   b. Fittings: Compression gasket joints meeting the requirements of ASTM C-564, or lead and oakum joints.

3. Pipe Size 15" (400 mm) and Smaller: Hubless cast-iron soil pipe.

   a. Pipe and fittings shall comply with ASTM A-888 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISBI).
   b. Fittings: Hubless couplings shall comply with CISBI Standard 310.
   c. Provide heavy duty shielded couplings for all aboveground piping.
   d. Heavy Duty Shielded Couplings: Heavy duty couplings shall be composed of a corrugated shield with a gauge .015, clamp assembly with a 3/8 inch worm gear tightened to a minimum of 80 inch pounds, a smooth shielded gauge of .025 tightened to 100-125 inch pounds or a cast iron shield tightened to 175 inch pounds and an elastomeric sealing sleeve conforming to ASTM C564. Heavy duty couplings shall be ANACO/Husky SD 4000 or equivalent by Clamp All or MG Couplings.

4. Pipe Size 24" (600 mm) and Smaller: Galvanized steel pipe.

   a. Pipe Weight: Schedule 40.
   b. Fittings: Class 125, galvanized cast-iron, drainage pattern, screwed joints.

C. Underground Drain Piping:

1. Pipe Size 15" (400 mm) and Smaller: Cast-iron hub and spigot soil pipe.

   a. Pipe and fittings to be service weight and shall comply with ASTM A-74 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISBI).
   b. Fittings: Compression gasket joints meeting the requirements of ASTM C-564, or lead and oakum joints.

D. Air Conditioning Condensate (above floor/roof):

1. 2" (50 mm) and Smaller: Copper.

   a. Wall Thickness: Type M.
   b. Fittings: Solder-joint.

E. Sump Pump Discharge: Galvanized steel pipe.

1. All sizes.

   a. Pipe Weight: Schedule 40.
   b. Fittings: Class 125, galvanized cast-iron, drainage pattern, screwed joints.

2.5 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division-22 section "Piping Specialties for Plumbing Systems", in accordance with the following listing:

1. Pipe Escutcheons
2. Drip-Pans
3. Pipe Sleeves
4. Sleeve Seals

2.6 HANGERS AND SUPPORTS

A. General: Provide supports and anchors complying with Division-22 section "Hangers and Supports for Plumbing Piping and Equipment".

2.7 SPECIAL VALVES

A. General: Special valves required for storm water piping systems include the following types:

1. Backwater Valves: Cast-iron body, bronze backwater valve assembly swing check type, with cleanout access cover. Provide ends to suit piping material; bolted cover.

2.8 SPECIAL EXPANSION COMPENSATION

A. General: Special expansion compensation products required for storm water piping systems include the following types:

1. Expansion Joints: Cast-iron body, adjustable bronze sleeve, bronze bolts with wing nuts; for vertical installation only.

2.9 SPECIAL PIPING SPECIALTIES

A. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.

2.10 CLEANOUTS

A. General: Provide factory-fabricated cleanouts of size and type indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and governing regulations.

B. Cleanouts in Piping: Cast-iron cleanout ferrule with bronze countersunk plug, suitable for no-hub applications.

C. Cleanouts in finished walls and partitions shall be similar to cleanouts in piping. Provide round polished stainless steel wall access cover with screw. Finish as per Architect.

D. Cleanouts in Tiled Floor: Cast-iron internal gasketed cleanout plug and adjustable housing with secured scoriated square satin Nikaloy top.

E. Cleanouts In Non-Tiled Floor: Similar to tiled floor type with a secured scoriated round satin Nikaloy top.

2.11 ROOF DRAINS

A. General: Provide roof drains of size as indicated on drawings; and type, including features, as specified herein:

1. Roof Drain: Cast-iron body and combined flashing collar, cast-iron dome, integral gravel stop with following features:

a. Underdeck clamp with support ring.
b. Adjustable extension.
c. Large sump with anchor flange.
d. Vandal-proof dome.
e. Bottom outlet, no-hub.
f. Perforated gravel guard, on ballasted roofs
g. Overflow ring dam; coordinate height with structural engineer

PART 3 - EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division-22 section "Identification for Plumbing Piping and Equipment".

3.2 INSTALLATION OF STORM WATER PIPING ABOVE GROUND

A. General: Install storm water piping in accordance with Division-22 section "Pipe, Tube, and Fittings for Plumbing Systems", and with National Standard Plumbing Code.

3.3 INSTALLATION OF BUILDING DRAIN PIPING

A. General: Install storm building drains as indicated and in accordance with National Standard Plumbing Code. Lay storm building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clear interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

B. Air conditioning (A/C) condensate piping shall be extended from all A/C condensate source equipment (air handling units, fan coil units, unit ventilators,

split system A/C units, etc.) and connected to the nearest storm water pipe/drain location. Size per manufacturer.

C. Install storm water piping pitched to drain at minimum slope of 1/8" per foot (10 mm per meter) (1%). Where possible, 1/4" per foot (20 mm per meter) (2%) shall be provided.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with requirements of Division-22 section "Piping Specialties for Plumbing Systems".

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Install supports and anchors in accordance with Division-22 section "Hangers and Supports for Plumbing Piping and Equipment".

3.6 INSTALLATION OF SPECIAL VALVES

A. Backwater Valves: Install in storm water piping as indicated, and as required by National Standard Plumbing Code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover, and of adequate size to remove valve cover for service. Install in such a manner to provide a maximum 1/4" (6 mm) clearance between flapper and seat for air circulation.

3.7 INSTALLATION OF SPECIAL EXPANSION COMPENSATION PRODUCTS

A. Expansion Joints: Install expansion joints on vertical risers as indicated, or as required by National Standard Plumbing Code.

3.8 INSTALLATION OF DRAINAGE PIPING PRODUCTS

A. Cleanouts: Install in conductor piping and storm building drain piping as indicated, as required by National Standard Plumbing Code; at each change in direction of piping greater than 45 degrees; at minimum intervals of 50 feet (15 m) for piping 4" (100 mm) and smaller and 75 feet (23 m) for larger piping; and at base of each conductor. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.

B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through waterproof membrane.

3.9 INSTALLATION OF DRAINS

A. General: Install drains in accordance with manufacturer's written instructions and in locations indicated.

B. Coordinate with roofing as necessary to interface roof drains with roofing work.

C. Coordinate with storm water piping as necessary to interface drains with drainage piping systems.

1. Install drains at low points of surface areas to be drained, or as indicated.
2. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.

D. Position drains so that they are accessible and easy to maintain.

3.10 PIPING TESTS

A. Test storm water piping system in accordance with requirements of Division-22 section "Pipe, Tube and Fittings for Plumbing Systems".

END OF SECTION 22 14 13

SECTION 22 30 00

PLUMBING EQUIPMENT

See Addendum #09. Section has been replaced

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of plumbing equipment work is indicated on drawings and provisions of this section, including schedules and equipment lists associated with either drawings or this section.

B. Types of plumbing equipment required for project include the following:

1. Domestic Water Heaters:

a. Commercial gas-fired water heaters

2. Domestic Water Expansion Tanks
3. Interceptors:

a. Grease interceptors

1.2 QUALITY ASSURANCE

A. UL and NEMA Compliance: Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.

B. NEC Compliance: Comply with National Electrical Code (ANSI/NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.

C. ANSI Compliance: Comply with ANSI Z223.1 (NFPA 54) “National Fuel Gas Code”, as applicable to installation of gas-fired water heaters.

D. ANSI Testing Standard: Water heaters shall comply with ANSI Z21.10.3 testing standard.

E. AGA and NSF Labels: Provide water heaters which have been listed and labeled by American Gas Association and National Sanitation Foundation.

F. ASME Code Symbol Stamps: For the following equipment, comply with ASME Boiler and Pressure Vessel Code for construction, and stamp with ASME Code symbol:

1. Commercial water heater
2. Domestic water expansion tank

G. ASME Relief Valve Stamps: Provide water heaters with safety relief valves bearing ASME valve markings.

H. PDI Compliance: Comply with applicable Plumbing and Drainage Institute standards pertaining to grease interceptors.

I. Water heaters shall comply with the Energy Policy Act of 2005 (EPACT-2005) and ASHRAE Standard 90.1b regarding energy efficiency. Minimum thermal efficiency shall be 78%.

J. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G)..

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's plumbing equipment specifications, installation and start-up instructions, and capacity and ratings, with selection points clearly indicated.

B. Shop Drawings: Submit assembly type shop drawings indicating dimensions, weights, required clearances, and methods of assembly of all components.

C. Wiring Diagrams: Submit ladder-type wiring diagrams for all components, clearly indicating all required field electrical connections.

D. Maintenance Data: Submit maintenance data and parts lists for each item of plumbing equipment. Include "trouble-shooting" maintenance guides. Include this data in maintenance manual.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER HEATERS

A. Commercial Gas-Fired Water Heaters:

1. General: Provide commercial gas-fired water heaters of size and capacity as indicated on schedule. Comply with ANSI/ASHRAE/IES 90A for energy efficiency. Provide certification of design by AGA under Volume III tests for commercial water heaters. Provide approval by NSF.
2. Heater: Working pressure of 150 psi (1020 kPa); boiler-type hand hole cleanout; magnesium anode rod; 3/4" (20 mm) tapping for relief valve; glass lining on internal surfaces exposed to water..
3. Safety Controls: Equip with automatic gas shutoff device to shut off entire gas supply in event of excessive temperature in tank; and pilot safety shutoff.
4. Draft Hood: Equip with AGA certified draft hood.
5. Jacket: Insulate tank with vermin-proof glass fiber insulation. Provide outer steel jacket with baked enamel finish over bonderized undercoating.
6. Warranty: Furnish three (3) year limited warranty for tank leakage.
7. Accessories: Provide brass drain valve; 3/4" (20mm) pressure and temperature relief valve; radian floor shield.
8. Controls: Provide gas pressure regulator with atmospheric vent; pilot gas regulator; thermostat.

2.2 DOMESTIC WATER EXPANSION TANK

A. Commercial Potable Water Expansion Tank:

1. General: Provide commercial potable water expansion tank suitable for use with potable water systems and with all wetted surfaces/components of the Food and Drug Administration approved materials. Comply with ASME Section VIII requirements.
2. Removable and replaceable heavy-duty butyl bladder.
3. Suitable for operating temperature up to and including 240°F (116°C).
4. Working pressure 150 PSIG (1034.4 Kpa) minimum. Shall be pre-charged to capacities as shown in schedule or shall be pre-charged to 60 PSI if no schedule is shown on the drawings.
5. Shall have charging valve with pressure gauge, lifting ring and 1" NPT drain connection on the side and on the bottom with plugs. Shall be suitable for horizontal or vertical mounting.
6. Acceptance capacities shall be as shown on the drawings, or if not shown on the drawings, shall have not less than eleven (11) gallons of acceptance volume minimum.

2.3 INTERCEPTORS

A. Grease Interceptors:

1. General: Provide pre-cast concrete two (2) compartment grease interceptor for underground installation. Refer to Grease Interceptor Detail on Contract Drawings for size and capacity and construction details. Conform to PDI G101, and provide PDI Seal of Approval.
2. Grease interceptor submittal shall include an engineered certified drawing with a current professional engineer’s stamp and signature to certify that the minimum retention time is in accordance with the requirements of the local authority having jurisdiction.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOMESTIC WATER HEATERS

A. Water Heaters (General):

1. General: Install water heaters as indicated, in accordance with manufacturer's installation instructions, and in compliance with applicable codes.
2. Support: Set units on concrete pads, orient so controls and devices needing service and maintenance have adequate access. Level and plumb unit.
3. Piping: Connect hot and cold water piping to units with unions. Provide shut off valve on cold water line. Connect recirculating water line to unit with shut off valve, check valve, and union.

B. Gas-Fired Water Heaters:

1. Gas Supply: Connect to gas line with drip leg, tee, gas cock, and union; full size of unit inlet connection. Locate piping so as not to interfere with service of unit.
2. Flue: Connect flue to draft hood with gas-tight connection.
3. Start-Up: Start-up, test, and adjust gas-fired water heaters in accordance with manufacturer's start-up instructions, and utility company's requirements. Check and calibrate controls, adjust burner for maximum efficiency.

3.2 INSTALLATION OF DOMESTIC WATER EXPANSION TANK

A. Domestic water expansion tank shall be securely suspended from the structure above or shall be pad mounted on a 4" high concrete pad.

B. Tie piping connection into cold water feed line to domestic water heater between shut-off valve and inlet of domestic water heater, or as indicated on the drawings. Provide shut-off valve and union on connecting pipe to allow service and inspection of expansion tank.

3.3 INSTALLATION OF INTERCEPTORS

A. General: Install interceptors as indicated, in accordance with manufacturer's installation instructions, and in compliance with applicable codes.

B. Support: Anchor interceptors securely to substrate, locate so adequate clearance is provided to remove covers and sediment baskets. Set recessed units so top of cover is flush with finished floor.

C. Piping: Connect inlet and outlet piping to interceptors.

END OF SECTION 22 30 00

SECTION 22 30 00

Addendum #09

PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of plumbing equipment work is indicated on drawings and provisions of this section, including schedules and equipment lists associated with either drawings or this section.

B. Types of plumbing equipment required for project include the following:

1. Domestic Water Heaters:

a. Commercial gas-fired water heaters

2. Domestic Water Expansion Tanks
3. Interceptors:

a. Grease interceptors

1.2 QUALITY ASSURANCE

A. UL and NEMA Compliance: Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.

B. NEC Compliance: Comply with National Electrical Code (ANSI/NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.

C. ANSI Compliance: Comply with ANSI Z223.1 (NFPA 54) “National Fuel Gas Code”, as applicable to installation of gas-fired water heaters.

D. ANSI Testing Standard: Water heaters shall comply with ANSI Z21.10.3 testing standard.

E. AGA and NSF Labels: Provide water heaters which have been listed and labeled by American Gas Association and National Sanitation Foundation.

F. ASME Code Symbol Stamps: For the following equipment, comply with ASME Boiler and Pressure Vessel Code for construction, and stamp with ASME Code symbol:

1. Commercial water heater
2. Domestic water expansion tank

G. ASME Relief Valve Stamps: Provide water heaters with safety relief valves bearing ASME valve markings.

H. PDI Compliance: Comply with applicable Plumbing and Drainage Institute standards pertaining to grease interceptors.

I. Water heaters shall comply with the Energy Policy Act of 2005 (EPACT-2005) and ASHRAE Standard 90.1b regarding energy efficiency. Minimum thermal efficiency shall be 78%.

J. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G)..

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's plumbing equipment specifications, installation and start-up instructions, and capacity and ratings, with selection points clearly indicated.

B. Shop Drawings: Submit assembly type shop drawings indicating dimensions, weights, required clearances, and methods of assembly of all components.

C. Wiring Diagrams: Submit ladder-type wiring diagrams for all components, clearly indicating all required field electrical connections.

D. Maintenance Data: Submit maintenance data and parts lists for each item of plumbing equipment. Include "trouble-shooting" maintenance guides. Include this data in maintenance manual.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER HEATERS

A. Commercial Gas-Fired Water Heaters:

1. General: Provide commercial gas-fired water heaters of size and capacity as indicated on schedule. Comply with ANSI/ASHRAE/IES 90A for energy efficiency. Provide certification of design by AGA under Volume III tests for commercial water heaters. Provide approval by NSF.
2. Heater: Working pressure of 150 psi (1020 kPa); boiler-type hand hole cleanout; ~~magnesium anode rod; 3/4" (20 mm) tapping~~ **and tapped** for relief valve; glass lining on internal surfaces exposed to water.
3. Safety Controls: Equip with automatic gas shutoff device to shut off entire gas supply in event of excessive temperature in tank; and pilot safety shutoff.
4. Draft Hood: Equip with AGA certified draft hood.
5. Jacket: Insulate tank with vermin-proof glass fiber insulation. Provide outer steel jacket with baked enamel finish over bonderized undercoating.
6. Warranty: Furnish ~~three (3)~~ **ten (10)** year limited warranty for tank leakage.
7. Accessories: Provide brass drain valve; 3/4" (20mm) pressure and temperature relief valve; radian floor shield.
8. Controls: ~~Provide gas pressure regulator with atmospheric vent; pilot gas regulator; thermostat.~~ **Heater shall employ an electronic operating**

control with digital temperature readout. Operator shall be capable of connecting to a building automation system through serial connection using Modbus RTU protocol. Combustion shall be controlled by an electronic flame safeguard with pre-purge and post-purge. Standard safety controls shall include a secondary operating limit, an automatic-reset high temperature limit and an ASME-rated temperature and pressure relief valve. Operating and safety controls shall meet the requirements of UL 795 and FM.

B. Manufacturers:

1. **Available Manufacturers: Manufacturer shall be a company specializing in manufacturing the products specified in this section with minimum five years' experience. The water heaters shall be manufactured by a company that has achieved certification to the ISO 9001 Quality Management System.**
2. **The water heaters shall be ETL listed as a complete unit. The heater shall satisfy current Federal Energy Policy Act standards for both thermal efficiency and stand-by heat losses as established for gas fired water heaters incorporating storage tanks.**
3. **Service Access: The water heater shall be provided with access covers for easily accessing all serviceable components. All gas train components must be accessible and able to adjust without the removal of cabinet components.**
4. **Manufacturers: PVI is the basis of design. Acceptable manufacturers shall be subject to compliance with the requirements. The storage capacity of the specified product represents the quantity of water available at usable temperature. The storage tanks from alternate suppliers will be upsized as necessary to equal the amount of water available at usable temperature in the specified product.**

C. Construction and Design:

1. **Water heater will be a 4-pass, fire tube, storage-type design firing natural gas.**
2. **The storage section of the water heater shall be ASME stamped and National Board Registered for a maximum allowable working pressure of 150 psi and pressure tested to 1-1/2 times working pressure.**
3. **All tank connections/ fittings shall be nonferrous and non 300 series stainless steel.**
4. **The storage tank shall be an unlined pressure vessel constructed from phase-balanced austenitic and ferritic duplex steel with a chemical structure containing a minimum of 21% chromium to prevent corrosion and mill certified per ASTM A 923Methods A to ensure that the product is free of detrimental chemical precipitation that affects corrosion resistance. The material selected shall be tested and certified to pass stress chloride cracking test protocols as defined in ISO 3651-2and ASTM G123 - 00(2005) "Standard Test Method for Evaluating Stress-Corrosion Cracking of Stainless Alloys with Different Nickel Content in Boiling Acidified Sodium Chloride Solution."**
5. **Waterside surfaces shall be welded internally utilizing joint designs to minimize volume of weld deposit and heat input. All heat affected zones (HAZ) shall be processed after welding to ensure the HAZ**

corrosion resistance is consistent with the mill condition base metal chemical composition. Weld procedures (amperage, volts, welding speed, filler metals and shielding gases) utilized shall result in a narrow range of austenite-ferrite microstructure content consistent with phase balanced objectives for welds, HAZ and the base metal.

6. **To attain the highest level of corrosion resistance to potable water and condensation, all internal and external surfaces shall undergo full immersion passivation and pickling processing to meet critical temperature, duration and chemical concentration controls required to complete corrosion resistance restoration of pressure vessel surfaces. Other passivation and pickling methods are not accepted. Immersion passivation and pickling certification documents are required and shall be provided with each product.**
7. **Materials shall meet ASME Section II material requirements and be accepted by NSF 61 for municipal potable water systems. Storage tank materials shall contain more than 80% post-consumer recycled materials and be 100% recyclable.**
8. **The pre-condensing heat exchanger shall be a fire tube design with the combustion chamber and all heating surfaces completely water-backed. The fireside of the combustion chamber shall be of boiler-grade steel. The waterside of the combustion chamber shall be non-ferrous. The fire tubes shall be solid copper. The heat exchanger shall be field removable from the pressure vessel, allowing 100% access to waterside surfaces.**
9. **The condensing heat exchanger shall consist of a series of u-bend fire tubes that are completely submerged in the lower section of the storage tank.**
10. **When heating water from 40°F to 140°F, the gas-fired water heater shall operate at a minimum 99% thermal efficiency at maximum burner firing rate.**
11. **Water heaters that must reduce firing rate to achieve thermal efficiency of 99% when heating water to 140°F will not be acceptable.**
12. **When tested to the ANSI Z21.10.3 efficiency standard, result shall be no less than 97% thermal efficiency at maximum burner firing rate.**
13. **Water heater will vent through PVC and can connect to PVC immediately at the appliance's vent connection.**

2.2 DOMESTIC WATER EXPANSION TANK

A. Commercial Potable Water Expansion Tank:

1. General: Provide commercial potable water expansion tank suitable for use with potable water systems and with all wetted surfaces/components of the Food and Drug Administration approved materials. Comply with ASME Section VIII requirements.
2. Removable and replaceable heavy-duty butyl bladder.
3. Suitable for operating temperature up to and including 240°F (116°C).
4. Working pressure 150 PSIG (1034.4 Kpa) minimum. Shall be pre-charged to capacities as shown in schedule or shall be pre-charged to 60 PSI if no schedule is shown on the drawings.

5. Shall have charging valve with pressure gauge, lifting ring and 1" NPT drain connection on the side and on the bottom with plugs. Shall be suitable for horizontal or vertical mounting.
6. Acceptance capacities shall be as shown on the drawings, or if not shown on the drawings, shall have not less than eleven (11) gallons of acceptance volume minimum.

2.3 INTERCEPTORS

A. Grease Interceptors:

1. General: Provide pre-cast concrete two (2) compartment grease interceptor for underground installation. Refer to Grease Interceptor Detail on Contract Drawings for size and capacity and construction details. Conform to PDI G101, and provide PDI Seal of Approval.
2. Grease interceptor submittal shall include an engineered certified drawing with a current professional engineer's stamp and signature to certify that the minimum retention time is in accordance with the requirements of the local authority having jurisdiction.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOMESTIC WATER HEATERS

A. Water Heaters (General):

1. General: Install water heaters as indicated, in accordance with manufacturer's installation instructions, and in compliance with applicable codes.
2. Support: Set units on concrete pads, orient so controls and devices needing service and maintenance have adequate access. Level and plumb unit.
3. Piping: Connect hot and cold water piping to units with unions. Provide shut off valve on cold water line. Connect recirculating water line to unit with shut off valve, check valve, and union.

B. Gas-Fired Water Heaters:

1. Gas Supply: Connect to gas line with drip leg, tee, gas cock, and union; full size of unit inlet connection. Locate piping so as not to interfere with service of unit.
2. Flue: Connect flue to draft hood with gas-tight connection.
~~**3. Start-Up: Start-up, test, and adjust gas-fired water heaters in accordance with manufacturer's start-up instructions, and utility company's requirements. Check and calibrate controls, adjust burner for maximum efficiency.**~~
3. Start-up on the gas fired water heaters, including flue gas analysis, will be performed by factory trained and authorized personnel. A copy of the startup report will be provided to the Owner.

3.2 INSTALLATION OF DOMESTIC WATER EXPANSION TANK

A. Domestic water expansion tank shall be securely suspended from the structure above or shall be pad mounted on a 4" high concrete pad.

B. Tie piping connection into cold water feed line to domestic water heater between shut-off valve and inlet of domestic water heater, or as indicated on the drawings. Provide shut-off valve and union on connecting pipe to allow service and inspection of expansion tank.

3.3 INSTALLATION OF INTERCEPTORS

A. General: Install interceptors as indicated, in accordance with manufacturer's installation instructions, and in compliance with applicable codes.

B. Support: Anchor interceptors securely to substrate, locate so adequate clearance is provided to remove covers and sediment baskets. Set recessed units so top of cover is flush with finished floor.

C. Piping: Connect inlet and outlet piping to interceptors.

END OF SECTION 22 30 00

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of plumbing fixture work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of plumbing fixtures specified in this section include the following:

1. Water Closets
2. Urinals
3. Lavatories
4. Sinks
5. Showers
6. Bathtubs
7. Electric Water Coolers
8. Mop Basins
9. Eyewashes

C. Refer to Division-22 sections for potable water systems used in conjunction with plumbing fixtures; not work of this section.

D. Refer to Division-22 sections for soil and waste systems used in conjunction with plumbing fixtures; not work of this section.

E. Refer to Division-26 sections for field-installed electrical wiring required for water coolers and other plumbing fixtures; not work of this section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of type, style and configuration required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. Plumbing Fixture Standards: Comply with applicable portions of National Standard Plumbing Code pertaining to materials and installation of plumbing fixtures.
2. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.
3. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
4. Federal Standards: Comply with applicable FS WW-P-541/-Series sections pertaining to plumbing fixtures.
5. NAHB Label: Provide fiberglass shower stalls which have been tested and labeled by NAHB Research Foundation Inc.
6. UL Compliance: Construct water coolers in accordance with UL Standards and provide UL listing and label.

7. ASHRAE Compliance: Test and rate water coolers in accordance with ASHRAE Standard 18 "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration Systems".
8. ARI Compliance: Construct and install water coolers in accordance with ARI Standard 1010 "Drinking-Fountains and Self-Contained Mechanically-Refrigerated Drinking-Water Coolers", and provide Certification Symbol.
9. ANSI Compliance: Construct and install barrier-free plumbing fixtures in accordance with ANSI Standard A117.1 "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People".

    a. Comply with Public Law 90-480, known as the Architectural Barriers Act of 1968.

10. ADA Compliance: Comply with provisions set forth in the "Americans with Disabilities Act Accessibility Guidelines."
11. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, furnished specialties and accessories; and installation instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, roughing-in requirements, required clearances, and methods of assembly of components and anchorages.

C. Maintenance Data: Submit maintenance data and parts lists for each type of plumbing fixture and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, and shop drawings in maintenance manual.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver plumbing fixtures individually wrapped in factory-fabricated containers.

B. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. General: Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture unless otherwise noted, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by manufacturer, and as required for complete installation.

Where more than one type is indicated, selection is Installer's option. All fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

WC-1 - Water Closet - Flush Valve: Vitreous china, floor mounted, high efficiency toilet, 1.28 gal/flush (4.9 L/flush) with siphon jet action, elongated bowl with open front seat and 1-1/2" (40 mm) inlet top spud with Sloan Royal Model 111-1.28 flush valve (complete with VBF-72-A trap primer where indicated on drawings). Mounting height shall be 15" (380 mm) to top of seat. Toto model no. CT-705-EN(G) water closet.

WC-2 - Water Closet - Flush Valve – ADA Compliant: Vitreous china, floor mounted, high efficiency toilet, 1.28 gal/flush (4.9 L/flush) with siphon jet action, elongated bowl with open front seat and 1-1/2" (40 mm) inlet top spud with Sloan Royal Model 111-1.28 flush valve (complete with VBF-72-A trap primer where indicated on drawings). Mounting height shall be 18" (450 mm) to top of seat. Toto model no. CT-705-ELN(G) water closet.

WC-3 – Water Closet: Vandal resistant, satin finish type 304 stainless steel, high efficiency toilet, 1.28 gal/flush (4.9 L/flush) with siphon jet action, rear mount, floor outlet water closet with elongated bowl, less punching for seat, metal template and wall sleeve. Mounting height shall be 15" (380 mm) to top of seat. Provide with Sloan HY-108-A push button actuator activated thru concealed flush valve and access panel equivalent to Sloan Easy Access Wall Box WB-1-A. Install easy access wall box directly in front of concealed flush valve. Acorn Model Meridian 2141-W-3-RM-HET-FVBO-LPFS-MT-SW water closet or equivalent. Flush valve shall be Sloan 9603-1.28 or equivalent.

WC-4 – Water Closet – ADA Compliant: Vandal resistant, satin finish type 304 stainless steel, high efficiency toilet, 1.28 gal/flush (4.9 L/flush) with siphon jet action, rear mount, floor outlet water closet with elongated bowl, less punching for seat, metal template and wall sleeve. Mounting height shall be 18" (450 mm) to top of seat. Provide with Sloan HY-108-A push button actuator activated thru concealed flush valve and access panel equivalent to Sloan Easy Access Wall Box WB-1-A. Install easy access wall box directly in front of concealed flush valve. Acorn Model Meridian 2141-W-3-RM-HET-FVBO-ADA-LPFS-MT-SW water closet or equivalent. Flush valve shall be Sloan 9603-1.28 or equivalent.

UR-1 – Urinal – ADA Compliant: Vitreous china, low water consumption, siphon jet urinal, 0.125 gal/flush (0.5 L/flush), 3/4" (20 mm) top spud and Sloan Royal Model 186-0.125 flush valve. Mounting height shall be 17" (432 mm) to top of rim. Toto model UT-447 urinal.

UR-2 – Urinal: Vandal resistant, satin finish type 304 stainless steel, wall mounted, 0.125 gal/flush (0.5 L/flush) urinal, 3/4" (20 mm) inlet. Provide with Sloan HY-108-A push button actuator activated thru concealed flush valve and access panel equivalent to Sloan Easy Access Wall Box WB-1-A. Install easy access wall box directly in front of concealed flush valve. Provide metal template and wall sleeve. Mounting height shall be 24" (610 mm) to top of rim. Acorn Penal-Ware 1709HEU-W-0.125-FVBO-MT-SW urinal or equivalent. Flush valve shall be Sloan Royal Model 9613-0.125 or equivalent.

UR-3 – Urinal – ADA Compliant: Vandal resistant satin finish type 304 stainless steel, wall mounted, 0.125 gal/flush (0.5 L/flush) urinal, 3/4" (20 mm) inlet. Provide with Sloan HY-108-A push button actuator activated thru concealed flush valve and access panel equivalent to Sloan Easy Access Wall Box WB-1-A.

Install easy access wall box directly in front of concealed flush valve. Provide metal template and wall sleeve. Mounting height shall be 17" (432 mm) to top of rim. Acorn Penal-Ware 1709HEU-W-0.125 urinal or equivalent. Flush valve shall be Sloan Royal Model 9613-0.125 or equivalent.

L-1 - Lavatory – Countertop – ADA Compliant: Sink integral to countertop under another division. Under this division provide deck mounted faucet with fittings 4" (100 mm) on center, 4" cast brass spout, 2" vandal proof (50 mm) wing handles with 0.5 gpm (.04 L/s) (max) aerator. Provide grid drain assembly, flexible supplies, tail piece and cast brass P-trap. Faucet shall be Chicago Faucets Model 802-1000-244CP or equivalent.

L-2 - Lavatory – Wall Mounted - ADA Compliant: Vandal resistant, satin finish type 304 stainless steel, wall mounted, front access with separate bottom enclosure, penal bubbler with pneumatically operated pushbutton, hot and cold 0.5 gpm (0.04 L/s) flow rate, with valve timing field adjustable from 5 to 60 seconds, lavatory overflow, metal template, wall sleeve, and wall mounting hardware. Acorn Penal-Ware 1652FA-1-BP-04-M-MT-OF-SW lavatory or equivalent.

L-3 - Lavatory - Wall Mounted - ADA Compliant: 18" x 20" (450 mm x 500 mm) vitreous china with front overflow, self-draining deck, wall mounted carrier and 4" (100 mm) centers. Provide deck mounted fittings 4" (100 mm) on center with 4" cast brass spout, 2" (50 mm) vandal proof wing handles with 0.5 gpm (.04 L/s) (max) aerator. Provide grid drain assembly, flexible supplies, tail piece and cast brass P-trap. Lavatory shall be American Standard "Lucerne" or equivalent. Faucet shall be Chicago Faucets Model 802-1000-244CP or equivalent.

CTS-1 - Single Compartment Countertop Sink: 21" x 15" (525 mm x 375 mm) inside dimension, 18-gauge (1.2 mm) type 304 stainless steel undermount single compartment sink with 3 hole punch. Provide deck mounted single hole faucet with 10" (250 mm) gooseneck, 4" (100 mm) single lever control handle and 1.5 gpm (5.7 L/min) (max) aerator, chrome basket strainer, flexible supplies, tailpiece and cast brass P-trap. Sink shall be Elkay "Lustertone" Model ELUHAD21150PD or equivalent. Faucet shall be Chicago Faucets Model 2300-E34ABCP or equivalent.

S-1 - Laundry Sink: Single compartment, enameled cast iron sink with wall hanger, rim guard and 2 hole drilled back on 8” (200 mm) centers. Provide 8" (200 mm) chrome plated solid brass faucet with 2” (50 mm) vandal proof lever handles, 5” (125 mm) rigid vacuum breaker/spout with 3/4” male hose thread and pail hook, supplies, stops and cast brass P-trap. Sink shall be American Standard Akron Service Sink or equivalent. Faucet shall be Chicago Faucets Model 445-897SRCXKCP or equivalent.

S-2 – Exam Sink: 21" x 15" (525 mm x 375 mm) inside dimension, 18-gauge (1.2 mm) type 304 stainless steel undermount sink with 3 hole punch and 8” (200 mm) centers. Provide deck mounted faucet with 8" (200 mm) gooseneck, 4" (100 mm) metal vandal proof wristblade handles, 0.5 gpm (1.9 L/min) (max) vandal proof aerator, chrome basket strainer, flexible supplies, tailpiece and cast brass P-trap. Sink shall be Elkay "Lustertone" Model ELUHAD211550PD or equivalent. Faucet shall be Chicago Faucets Model 201-G8AE2805F317AB or equivalent.

S-3 – Dental Sink: 21" x 15" (525 mm x 375 mm) inside dimension, 18 gauge (1.2 mm) type 304 stainless steel undermount sink with 3 hole punch and 8" (200 mm) centers. Provide deck mounted faucet with 8" (200 mm) gooseneck, 4" (100 mm) metal vandal proof wristblade handles and 0.5 gpm (1.9 L/min) (max) vandal proof aerator, chrome basket strainer, flexible supplies, and tailpiece. Sink shall be Elkay "Lustertone" Model ELUHAD211550PD or equivalent. Faucet shall be Chicago Faucets Model 201-G8AE2805F317AB or equivalent.

S-4 – Lab Sink: 21" x 15" (525 mm x 375 mm) inside dimension, 18 gauge (1.2 mm) type 304 stainless steel undermount sink with 3 hole punch and 8" (200 mm) centers. Provide deck mounted faucet and faucet-mount eyewash, with 8" (200 mm) gooseneck, 4" (100 mm) metal vandal proof wristblade handles and 0.5 gpm (1.9 L/min) (max) vandal proof aerator on faucet, chrome basket strainer, flexible supplies, tailpiece and cast brass P-trap. Sink shall be Elkay "Lustertone" Model ELUHAD211550PD or equivalent. Faucet shall be Chicago Faucets Model 201-G8AE2805F317AB or equivalent. Eyewash shall be Bradley S19-200B with optional 3/4"female chrome adapter or equivalent.

SH-1 – Shower (Base/Head Assembly/Controls): Provide 36" x 36" (900 mm x 900 mm) precast terrazzo shower base with integral brass drain body and flanges on three sides. Polished terrazzo shall be constructed of marble chips cast in Portland cement producing a compression strength of 3000 psi (20400 kPa) or more. Provide combination temperature and pressure balancing shower valve of cast brass construction with single lever control and chrome plated adjustable shower head. Base shall be Florestone Model 200 or equivalent. Shower assembly/controls shall be Powers Hydroguard T/P e710J10000 or equivalent.

SH-2 – Shower (Base/Head Assembly/Controls) – ADA Compliant: Provide 36" x 36" (900 mm x 900 mm) barrier free, precast terrazzo shower base with integral brass drain body and flanges on three sides. Polished terrazzo shall be constructed of marble chips cast in Portland cement producing a compression strength of 3000 psi (20400 kPa) or more. Provide combination temperature and pressure balancing shower valve of cast brass construction with single lever control, shower head, hand spray with 60" stainless steel flexible hose and 24" (600 mm) stainless steel ADA wall grab bar. Base shall be Florestone Model 500 or equivalent. Shower assembly/controls shall be Powers Hydroguard T/P e71010000100 or equivalent.

SH-3 – Shower (Base/Head Assembly/Controls) – Penal Grade: Provide 36" x 36" (900 mm x 900 mm) precast terrazzo shower floor with integral brass drain body and flanges on three sides. Polished terrazzo shall be constructed of marble chips cast in Portland cement producing a compression strength of 3000 psi (20400 kPa) or more. Provide front access, satin finish 14 gauge (2.1 mm) type 304 stainless steel recessed wall shower panel, 1.6 gpm (6.0 L/min) flow control shower head and recessed soap dish. Trim shall be chrome-plated brass. Shower valve shall be air-control, hot and cold metering, non-hold open type. Base shall be Florestone Model 200 or equivalent. Shower head assembly/controls shall be Acorn Penal-Ware 1741FA-04-M-F-RD or equivalent.

SH-4 – Shower (Base/Head Assembly/Controls) – Penal Grade – ADA Compliant: Provide 36" x 36" (900 mm x 900 mm) barrier free precast terrazzo shower floor with integral brass drain body and flanges on three sides. Polished terrazzo shall be constructed of marble chips cast in Portland cement producing a compression strength of 3000 psi (20400 kPa) or more. Provide front access,

satin finish 14 gauge (2.1 mm) type 304 stainless steel recessed wall shower panel, 1.6 gpm (6.0 L/min) flow control shower head, a hand shower with vacuum breaker, quick disconnect and mounting bracket, and recessed soap dish. Trim shall be chrome-plated brass. Shower valve shall be air-control, hot and cold metering, non-hold open type, ADA compliant. Base shall be Florestone Model 500 or equivalent. Shower head assembly/controls shall be Acorn Penal-Ware 1741ADAFA-04-M-F-RD or equivalent.

SH-5 – Shower (Head Assembly/Controls) – Penal Grade: Provide front access, satin finish 14 gauge (2.1 mm) type 304 stainless steel recessed wall shower panel, 1.6 gpm (6.0 L/min) flow control shower head and recessed soap dish. Trim shall be chrome-plated brass. Shower valve shall be air-control, hot and cold metering, non-hold open type. Shower head assembly/controls shall be Acorn Penal-Ware 1741FA-04-M-F-RD or equivalent.

SH-6 – Shower (Head/Controls) – Penal Grade – ADA Compliant: Provide front access, satin finish 14 gauge (2.1 mm) type 304 stainless steel recessed wall shower panel, 1.6 gpm (6.0 L/min) flow control shower head, a hand shower with vacuum breaker, quick disconnect and mounting bracket, and recessed soap dish. Trim shall be chrome-plated brass. Shower valve shall be air-control, hot and cold metering, non-hold open type, ADA compliant. Shower head assembly/controls shall be Acorn Penal-Ware 1741ADAFA-04-M-F-RD or equivalent.

SH-7 – Shower (Base/Head Assembly/Controls) – Penal Grade – ADA Compliant: Provide nominal 30” x 60” (750 mm x 1500 mm) barrier free precast terrazzo shower floor with integral brass drain body and flanges on three sides. Polished terrazzo shall be constructed of marble chips cast in Portland cement producing a compression strength of 3000 psi (20400 kPa) or more. Provide front access, satin finish 14 gauge (2.1 mm) type 304 stainless steel recessed wall shower panel, 1.6 gpm (6.0 L/min) flow control shower head, a hand shower with vacuum breaker, quick disconnect and mounting bracket, and recessed soap dish. Trim shall be chrome-plated brass. Shower valve shall be air-control, hot and cold metering, non-hold open type, ADA compliant. Base shall be Florestone Model 400 or equivalent. Shower head assembly/controls shall be Acorn Penal-Ware 1741ADAFA-04-M-F-RD or equivalent.

BT-1 – Bathtub/Shower – ADA Compliant: Provide 60” x 30” x 14” (1524 mm x 762 mm x 356 mm) straight front, recessed, enameled cast iron, slip resistant bathtub with integral apron and tilting flange, integral lumbar support, integral overflow and drain assembly, lift and drain stopper assembly and escutcheon. American Standard Princeton Bathtub or equivalent. Provide recessed Shower/Tub control panel, Acorn M1741-E576-5 ADAFA Flush Mounted Shower with Tub Spout or equivalent with Acorn Type 8 T/P temperature/pressure balancing mixing valve with air control valve and Acorn Model SV16 diverter valve located within recessed panel. Panel shall include upper and lower conical shower heads, conical tub spout, pushbuttons for upper and lower shower heads and tub spout, and all controls shall be front panel accessible.

EWC-1 - Electric Water Cooler with Bottle Filling Station – Bi-Level, Wall Mounted - ADA Compliant: Unit shall be bi-level, non-corrosive, stainless steel with satin finish, with vandal resistant front pushbutton activation, an automatic 20 second bottle filler shutoff timer, a 3000 gallon capacity filtration system, and a visual user interface display for bottles filled and filter monitor. Bubbler shall be chrome plated, vandal resistant, non-removable, regulated and anti-squirt with integral hood. Unit shall be similar to Haws #1011 high/low arrangement with single piece wall mounting plate. Integral chiller shall be capable of producing 8 gph of 50°F chilled drinking water at 90°F ambient and 80°F inlet water, 115V, 5A rating. Elkay Model LVRCTL8WS or equivalent.

EWC-2 - Electric Water Cooler with Bottle Filling Station – Single, Wall Mounted - ADA Compliant: Unit shall be single, non-corrosive, stainless steel with satin finish, with vandal resistant front pushbutton activation, an automatic 20 second bottle filler shutoff timer, a 3000 gallon capacity filtration system, and a visual user interface display for bottles filled and filter monitor. Bubbler shall be chrome plated, vandal resistant, non-removable, regulated and anti-squirt with integral hood. Unit shall be similar to Haws #1011 high/low arrangement with single piece wall mounting plate. Integral chiller shall be capable of producing 8 gph of 50°F chilled drinking water at 90°F ambient and 80°F inlet water, 115V, 5A rating. Elkay Model LVRCGRN8WSK or equivalent.

MB-1 - Mop Basin - Floor Mounted: One piece, white molded stone, 24" x 24" x 10" deep, factory installed stainless steel drain body with strainer, fitted with stainless steel wall guard, vinyl bumper guards, wall mounted faucet with vacuum breaker spout, mop hanger, and hose with bracket. Mop Basin shall be Fiat Model MSB 2424 or equivalent. Faucet shall be Chicago Model 897-CCP or equivalent.

WMC-1 – Washer Machine Connection – Recessed, Wall Mounted: Galvanized steel, with 1/2" NPT/sweat connection, 2” threaded drain and locknut, overflow guard, and satin plated faucets and connectors. Guy Gray FB200 or equivalent as required by domestic water and waste piping arrangement.

EW-1 – Faucet-Mount Eyewash: Universal mount for gooseneck or standard faucet, chrome plated brass sprayhead assembly with twin soft-flow eyewash heads and highly visible yellow plastic protective covers, diverter pin operated. Provide chrome plated 3/4"female chrome adapter. Bradley S19-200B eyewash or equivalent.

B. All plumbing fixtures indicated to be ADA compliant on the mechanical or architectural drawings shall comply with the "Americans with Disabilities Act Accessibility Guidelines". ADA compliant plumbing fixtures shall meet the latest ADA requirements and installation guidelines shall include, but not be limited to, the following:

Water Closets: Top of seat shall be greater than 17 inches (425 mm) but not to exceed 19" (475 mm) above finished floor. Flush controls shall be hand operated or automatic. The force required to activate operable parts shall be 5 pounds (34 kPA) maximum. Flush controls shall be located on the open or wide side of the water closet (not at centerline of toilet). Flush valve not to exceed 44" (1100 mm) above finished floor for obstructed high reach.

Urinals: Top of rim shall not exceed 17" (425 mm) above finished floor for wall hung type. Flush controls shall be hand operated or automatic. The force required to activate operable parts shall be 5 pounds (34 kPA) maximum. Flush valve not to exceed 44" (1100 mm) above finished floor for obstructed high reach.

Lavatories/Sinks: Top of rim or counter shall not exceed 34" (850 mm) above finished floor. Knee space clearance below lavatory apron shall be a minimum of 27” (675 mm). Faucets may be lever operated, push button or electronically controlled; however, hand operated metering faucets must remain open for a minimum of 10 seconds. Faucets also must not require more than 5 pounds (34 kPa) of force to activate the control, and the control must be operable without tight grasping, pinching or twisting of the wrist. Where piping is exposed beneath the lavatory, provide manufactured premolded insulated pipe for exposed hot water, cold water and sanitary drain piping, Lavguard or equivalent.

Water Coolers: Water cooler shall be mounted at 27” (675 mm) above finished floor to bottom of apron. Water spout height shall not exceed 36" (900 mm) above finished floor.

Showers/Bath Tubs: In bathtubs, controls, other than drain stoppers, shall be located on an end wall such that they are located between the bathtub rim and grab bar, and between the open side of the bathtub and the centerline of the width of the bathtub. In transfer type shower compartments, the controls, faucets, and shower spray unit shall be installed on the side wall opposite the seat 38 inches (965 mm) minimum and 48 inches (1220 mm) maximum above the shower floor and shall be located on the control wall 15 inches (380 mm) maximum from the centerline of the seat toward the shower opening. In standard roll-in type shower compartments, the controls, faucets, and shower spray unit shall be located above the grab bar, but no higher than 48 inches (1220 mm) above the shower floor. Where a seat is provided, the controls, faucets, and shower spray unit shall be installed on the back wall adjacent to the seat wall and shall be located 27 inches (685 mm) maximum from the seat wall. Shower sprayers must have both fixed and hand-held use capabilities, with a 60" (1500 mm) flexible hose. (A fixed head may be used in vandal-prone areas.) The shower spray unit shall have an on/off control with a non-positive shut-off. Controls require activation pressures not exceeding 5 pounds (34 kPa) of force nor requiring tight grasping, pinching or twisting of the wrist.

2.2 MATERIALS

A. General: Unless otherwise specified, comply with applicable Federal Specification WW-P-541 Series sections pertaining to plumbing fixtures, fittings, trim, metals and finishes. Comply with requirements of WW-P-541 specification

relative to quality of ware, glazing, enamel, composition and finish of metals, air gaps, and vacuum breakers, even though some plumbing fixtures specified in this section are not described in WW-P-541.

B. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.

C. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.

D. Stainless Steel Sheets: ASTM A 167, Type 302/304, hardest workable temper.

1. Finish: No. 4, bright, directional polish on exposed surfaces.

E. Steel Sheets for Baked Enamel Finish: ASTM A591, coating Class C, galvanized-bonderized.

F. Steel Sheets for Porcelain Enamel Finish: ASTM A424, commercial quality, Type I.

G. Galvanized Steel Sheet: ASTM A526, except ASTM A527 for extensive forming; ASTM A525, G90 zinc coating, chemical treatment.

H. Aluminum: ASTM B209/B221 sheet, plate and extrusions, as indicated; alloy, temper and finish as determined by manufacturer, except 0.40 mil natural anodized finish on exposed work unless another finish is indicated.

I. Plastic Laminate: NEMA LD3, general purpose high pressure type, 0.050" thick, smooth (non-textured) white unless another texture and color are indicated or selected by the Owner.

J. Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C 554.

K. Fiberglass: ANSI Z124, smooth surfaced, with color selected by the Owner.

L. Synthetic Stone: High quality, free from defects, glaze on exposed surfaces, stain resistant.

2.3 PLUMBING FITTINGS, TRIM AND ACCESSORIES

A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.

1. Vacuum Breakers: Provide with flush valves where required by governing regulations, including locations where water outlets are equipped for hose attachment.

B. P-Traps: Include removable P-traps where drains are indicated for direct connection to drainage system.

C. Provide cast-iron supports for fixtures of either graphitic gray iron, ductile iron, or malleable iron as required.

D. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

E. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome-plated sheet steel escutcheons with friction clips.

F. Aerators: Provide aerators of types approved by the Owner, and complying with flow constrictions, hereinbefore specified.

G. Comply with additional fixture requirements contained in fixture schedule indicated on the Drawings.

2.4 TRAP PRIMERS

A. Prime all floor drain and floor sink traps with trap seal primer valve having integral vacuum breaker.

B. Install primer valve in cold water service line to nearest plumbing fixture and extend in concealed copper piping to trap.

C. Provide timer operated flush valve trap priming systems in the kitchen area and connect to all floor drains and floor sinks associated with kitchen area.

2.5 LABORATORY FURNITURE

A. Laboratory furniture complete with loose plumbing trim is furnished under another Division. Under this Section, rough-in, set trim and make final connections, including trap. Furnish and install traps for all laboratory furniture and equipment.

B. Piping shall be run within casework. Provide support for horizontal concealed runs of service piping within casework utilizing Unistrut systems of floor supports, slotted channel members and pipe clamps.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PLUMBING FIXTURES

A. General: Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of National Standard Plumbing Code pertaining to installation of plumbing fixtures.

B. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.

C. Protect installed fixtures from damage during remainder of construction period.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by the Owner. Remove cracked or dented units and replace with new units.

3.4 ADJUSTING AND CLEANING

A. Clean plumbing fixtures, trim, and strainers of dirt and debris upon completion of installation.

B. Adjust water pressure at water coolers, faucets, shower valves, and flush valves to provide proper flow stream and specified gpm.

C. Adjust or replace washers to prevent leaks at faucets and stops.

3.5 EXTRA STOCK

A. General: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to the Owner with receipt. Furnish one (1) device for every ten (10) units.

END OF SECTION 22 40 00

SECTION 22 54 81

SOLAR WATER HEATING SYSTEM

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. Provide a solar energy system arranged for preheating of service domestic water using evacuated tube solar collectors. The system shall include all components required for a complete installation including controls and communications.

1.2 QUALITY ASSURANCE

A. UL and NEMA Compliance: Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.

B. NEC Compliance: Comply with National Electrical Code (ANSI/NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.

C. SRCC Certification: All work associated with the solar water heating system shall be installed by individuals certified by the Solar Rating and Certification Corporation (SRCC) and/or the North American Board of Certified Energy Practitioners (NABCEP).

D. NSPC Compliance: Installation shall be in accordance with the 2003 National Standard Plumbing Code with the 2004 Supplement.

1.3 SUBMITTALS

A. Provide the following:

1. Drawings containing a system schematic.
2. Collector layout and roof plan noting reverse-return piping for the collector array.
3. System elevation.
4. Equipment room layout.
5. Schedule of operation and installation instructions; and a schedule of design information including collector height and width, recommended flow rate and pressure drop at that flow rate, and number of collectors to be grouped per bank.

B. Include on the drawings complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work, including clearances for maintenance and operation. As-built drawings as specified.

C. Product Data:

1. Spare parts
2. A complete list of equipment and materials, as specified.
3. Solar Energy System:

a. Manufacturer's descriptive and technical literature; performance chart and curves; catalog cuts; and installation instructions. Proposed diagrams, instructions, and other sheets, prior to posting. A copy of the posted instructions proposed to be used, including a system schematic, wiring and control diagrams, and a complete layout of the entire system. Include with the instructions, in typed form, condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation and procedures for safely starting and stopping the system, methods of balancing and testing flow in the system, and methods of testing for control failure and proper system operation.

4. Operation and Maintenance Data:

a. Operation and Maintenance Procedures: Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set prior to performance testing and the remainder upon acceptance. Manuals shall be approved prior to the field training course. Operating manuals shall detail the step-by-step procedures required for system filling, startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, service manual, parts list, and brief descriptions of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, piping and equipment layout, balanced fluid flow rates, and simplified wiring and control diagrams of the system as installed.

1.4 WELDER QUALIFICATIONS

A. Qualify procedures and welders in accordance with the code under which the welding is specified to be accomplished.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect all equipment delivered and placed in storage from the weather, excessive humidity and excessive temperature variation, and dirt and dust or other contaminants.

1.6 WARRANTY

A. Flat plate collectors and frames and connection kits shall be covered by a non-prorated 10-year manufacturer’s warranty. Pump station, controller, expansion tank, balance valves and diverting valves shall be warranted for a minimum of

one (1) year by the manufacturer. Include in the warranty full repair or replacement of defective materials or equipment.

1.7 SPARE PARTS

A. Submit data for each different item of material and equipment listed, including a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of equipment, or specified to be furnished as part of the contract; and a list of additional items recommended by the manufacturer to ensure efficient operation for a period of 120 days.

PART 2 - PRODUCTS

2.1 SOLAR THERMAL SYSTEM

A. General:

1. The solar water heating system shall be manufactured and designed by Kingspan Solar or equivalent. The system is designed to act as a stand-alone source of hot water and shall be provided by a representative of a NABCEP Certified Solar Distributor. The solar system shall include all components required for a complete installation, including controls and communications, which shall be integrated into the package.
2. The system shall consist of, but not be limited to, the following basic equipment:

    a. Flat Plate Collectors (minimum of 15)
    b. Solar Controller
    c. Pump Skid Station
    d. Thermostatic Balance Valves (minimum of 1)
    e. Motorized and Ball Valves (minimum of 1)
    f. Glycol
    g. Solar Expansion Tank
    h. Piping Systems
    i. Heat Dissipator

3. Each of the system components listed above have been designed and specified to meet the highest quality standards, to provide optimum energy production, low maintenance, and maximum flexibility.

B. Flat Plate Collectors:

1. Solar collectors shall be manufactured by Kingspan Solar model number FPW30 and shall be a single collector sheet harp design flat plate collector.
2. The collector dimensions shall be 96” X 48” X 3 $^{1}/_{2}$”. The collector frame material shall be electrostatic painted aluminum.
3. The sides and back of the collector shall be insulated with rock wool insulation with a minimum thickness on the back of 2”.

4. The piping and absorber plate shall be manufactured of copper and the two parts be ultrasonically welded to each other during manufacture.
5. The coating on the absorber plate shall be TiNOx with absorption of at least 96% and emission less than 4%.
6. The frames which the collector mounts to shall be made from extruded aluminum and include all of the necessary fittings to mount the collector to the frame. All clips and bolts shall be manufactured from stainless steel.
7. The efficiency of the collector, as defined by the SRCC on the gross area of the collector shall meet, or exceed the following conditions: Optical Efficiency at least 0.698, a_1 heat loss no more than 3.213 W/m^2K, a_2 heat loss no more than 0.00570 $W/m^2°K^2$.
8. The efficiency of the collector, as defined by the Solar Keymark EN12975 on the aperture area of the collector shall meet, or exceed the following conditions: Optical Efficiency at least 0.785, a_1 heat loss no more than 3.722 W/m^2K, a_2 heat loss no more than 0.012 W/m^2K^2
9. Manufacturers: Kingspan Solar FPW30 is the basis of design. Alternative manufacturers include Viessmann, NARVA or S-Power.

C. Solar Controller:

1. The pump station requires a dedicated 15A 120VAC single phase circuit to operate on. The wiring external to the pump station shall be provided by the installer and shall be installed as to meet all electrical code.
2. The solar controller shall consist of a Kingspan MX controller with (12) dedicated PT1000 temperature sensor inputs, (4) pulse type flow meter or PT1000 inputs, (1) input for a pyronometer, (2) inputs for Grundfos direct analog sensors, (2) inputs for Grundfos direct digital sensors, (13) 120 VAC powered relay outputs, (1) dry relay contact, (4) 0 – 10V pump speed control outputs and one output for VBus connectivity between devices.
3. A Kingspan DL3 data logger shall also be included that allows for Internet connectivity that allows for all controller parameters to be monitored remotely.
4. Additional sensors are required to be mounted at various points in the system. These sensors shall be provided by the pump station manufacturer with instructions as to the proper places they are to be mounted in the system. The contractor shall connect these sensors to the electrical enclosure and place them in the locations detailed in the installation instructions and diagrams. The additional sensors shall include a pyronometer, outdoor temperature sensor and temperature sensors in the tanks and in the collectors. Additional sensors may be required; refer to system diagram for more information. All sensor wiring shall be specified by the system manufacturer and provided and installed by the installing contractor.
5. The system manufacturer shall provide an SD memory card with the system program saved on it so that it can be loaded into the controller at the job site by the installer. In addition, all parameters shall be documented in case the program is lost.
6. Solar controller shall be Kingspan MX Controller.

D. Pump Skid Station:

1. The pump station shall be shipped as a single unit dimensions 36.25” X 28.75” X 14.5” and shall mount on wall.

2. The pump on the solar loop of the station shall be a Wilo Stratos 1.25X3-35 and shall have a cast iron housing. The pump shall take a 0-10v signal from the controller to vary the pump speed depending on the amount of solar radiation being received.
3. The pump on the secondary loop of the station shall be a Wilo Stratos 1.25X3-25 and shall have a bronze housing. The pump shall take a 0-10v signal from the controller to vary the pump speed depending on the amount of solar radiation being received.
4. The solar loop shall have the following components: check valves, ball valves, pressure relief valve, expansion tank connection, visual flow meter, electronic flow meter, electronic temperature sensors on both the supply and return, temperature gages on both supply and return, an air separator, pressure gage and flush and fill ports for the glycol loop. The specifications of the electrical components are covered further in the controller section.
5. The secondary loop shall have the following components: visual flow meter, temperature sensors on the supply and return, air vents and proportional valves that with positive closing on the supply and return to the unit.
6. The pump station shall have a built in heat exchangers capable of 240,000 BTU/hr heat transfer with an effectiveness of at least 0.4. The heat exchangers shall be double walled with positive leak detection. The material shall be stainless steel with copper brazing.
7. The pump station shall have 1" female NPT connections on both the solar side and the secondary.

E. Thermostatic Balance Valves:

1. Combination balance valves and flow meters shall be provided on each bank of collectors for systems with multiple banks to allow for the measurement of flow to individual banks of collectors and the adjustment of flow.
2. The balance valves shall have ¾" copper sweat tails for connection to the piping, a scale that displays flows from ½ to 5 GPM, a brass body with composite window to view the flow rate, 150 PSI or higher pressure rating and 250°F or higher maximum temperature rating.

F. Motorized and Ball Valves:

1. Diverting valves shall have brass bodies if located in the solar loop and stainless steel bodies if being used in the potable water section of the system.
2. The valve housing shall be IP65 or IP67 rated and UV resistant to allow for mounting outside, if necessary. The valve shall include an automatic torque limiter to prevent jamming of the valve, a LED indicator to show the status of the valve and a manual override with valve position indicator.
3. The valve and actuator shall be rated for 1000 PSI minimum and 266°F maximum temperature.
4. The valve actuator shall connect to the solar controller and use 120VAC to switch the valve in a power open, power close configuration. The maximum current draw shall be less than 0.35A with 120VAC.
5. The installing contractor is responsible for supplying and connecting the proper wiring from the controller to the valve per the local electrical code.

G. Glycol

1. Tyfocor LS is the basis of design.
2. The glycol provided with the system shall be premixed at 42% concentration as to provide freeze protection down to -18°F.
3. The glycol shall have corrosion inhibitors as to minimize the rate of corrosion in the system.
4. The glycol shall be specifically designed for solar systems, with operating temperatures of up to 338°F without degradation of the fluid and peak temperatures of up to 392°F with minimal degradation of the fluid.

H. Solar Expansion Tank

1. The solar expansion tank shall be designed to take up the volume of fluid expansion in the system as well as the volume of fluid in the collectors during stagnation. This calculation shall be provided by the solar manufacturer, along with the precharge pressure of the bladder.
2. The tank shall meet ASME Section VIII Boiler code, have a butyl bladder, be capable of withstanding at least 125 psi pressure and 240°F, have a top NPT connection port and a Schroeder valve connection for pressurizing the tank.
3. The tank shall have 35 gallons volume and measure 16”Ø X45”.

I. Piping System:

1. Piping for solar systems shall be type L or K copper, 316L stainless tubing, Sch 5, or Sch 10 316L stainless pipe. Plastic or PEX pipe shall not be permitted. If copper pipe is used, flow velocities in pipe and fittings shall be limited to 2 FPS (feet per second). If 316L material is used, flow velocities of up to 8 FPS may be used. Joints shall be made to meet local and international plumbing codes.
2. Block and isolation valves shall be of ball construction, and either brass or 316L stainless steel. Valves shall be rated at 350°F and able to meet NSF 61 certification.

PART 3 - EXECUTION

3.1 EXAMINATION

A. After becoming thoroughly familiar with all details of the work, verify all dimensions in the field, and advise the Architect/Engineer of any discrepancy before performing any work.

3.2 INSTALLATION OF SOLAR WATER HEATING SYSTEM

A. Follow all of the safety, installation, and warranty information contained in the manufacturer’s manuals. Before operating the system, the contractor shall carry out the post-installation checklist.

B. Observe local building code guidelines for maximum load restrictions on the substructure and for necessary distance to roof edge. Consult with a structural engineer if there is any doubt about the suitability of the roof structure for

installing solar collectors. Collectors shall be mounted securely, so that even during gale force wind, the mounting clamps can reliably absorb any tension.

C. An air vent with a shut off valve shall be installed at the highest point in the system. Provide a fast air vent C/W shut-off valve for this purpose. After the system has been de-aerated, the air vent valve shall be closed.

D. Piping connections shall only be made with metal piping (commercial copper or non-galvanized steel). Plastic piping is not suitable. The maximum flow shall not exceed 2 ft/sec for copper pipes carrying temperatures above 160°F. The piping shall be properly supported to prevent sagging, and shall slope back a minimum of 1/4" / 10 ft.

E. All piping shall be insulated and shall be provided by the installing contractor. The minimum insulation thickness shall be 1 1/2" for piping 1" and less, and 2" for piping larger than 1". The insulation shall have a minimum temperature rating above 250°F. All exterior insulation shall be protected from weather with water tight, UV resistant jacket. An aluminum jacket or enclosure shall be provided for exterior piping insulation. Insulation shall be Armaflex HT or equivalent.

F. Solar collectors, control and pump stations, and balance of system components shall be installed by a factory approved contractor and/or a contractor with NABCEP solar thermal certification. Contractor shall have experience in installing commercial flat plate solar systems of a comparable size to this installation. A factory representative shall provide:

1. Pre-construction training and/or certification for the installing contractor.
2. Inspection services during installation
3. System start-up services
4. Operational and Maintenance training for onsite personnel.

END OF SECTION 22 54 81

SECTION 22 63 00

NATURAL GAS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of natural gas systems work is indicated on drawings and schedules, and by requirements of this section.

B. Refer to Division-02 sections for trenching and backfill required in conjunction with gas service piping; not work of this section.

1.2 QUALITY ASSURANCE

A. Specimen Joints: Before commencing pipe laying, Contractor shall form specimen joints to demonstrate, to the satisfaction of the Owner, that materials and methods employed will result in watertight joints.

B. Qualification of Installers: The entire gasket system shall be installed by trained workmen skilled in the installation of such systems.

C. Codes and Standards:

1. ASME Compliance: Fabricate and install natural gas piping in accordance with ASME B31.2 "Fuel Gas Piping".
2. NFPA Compliance: Fabricate and install natural gas systems in accordance with NFPA 54 "National Fuel Gas Code".
3. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company.
4. UMC Compliance: Fabricate and install natural gas systems in accordance with IAPMO "Uniform Mechanical Code".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for natural gas systems materials and products.

B. Maintenance Data: Submit maintenance data and parts lists for natural gas systems materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, pipes, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with NFPA 54 where

applicable and base pressure rating on natural gas piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials use in natural gas systems. Where more than one type of materials or products is indicated, selection is Installer's option.

2.2 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-22 sections "Basic Plumbing Materials and Methods" and "Identification for Plumbing Piping and Equipment", in accordance with the following listing:

1. Building Distribution Piping: Plastic pipe markers.
2. Gas Service: Underground-type plastic line markers.
3. Gas Valves: Plastic valve tags.

2.3 BASIC PIPES AND PIPE FITTINGS

A. General: Provide pipes and pipe fittings complying with Division-22 sections "Basic Plumbing Materials and Methods" and "Pipe, Tube and Fittings for Plumbing Systems", in accordance with the following listing:

B. Gas Service Piping:

1. All Pipe Sizes: Black steel pipe; Schedule 40; wrought-steel buttwelding.

a. Wrapping: Machine wrap pipe using 50% overlap wrap, with polyvinyl chloride tape. Hand wrap fittings using 100% overlap wrap extending 6" (150 mm) beyond fitting onto wrapped pipe. Comply with tape manufacturer's installation instructions.

C. Building Distribution Piping:

1. Pipe Size 2" (50 mm) and Smaller: Black steel pipe; Schedule 40; malleable-iron threaded fittings.
2. Pipe Size 2-1/2" (65 mm) and Larger: Black steel pipe; Schedule 40; wrought-steel buttwelding fittings.

2.4 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division-22 sections "Basic Plumbing Materials and Methods" and "Piping Specialties for Plumbing Systems", in accordance with the following listing:

1. Pipe escutcheons
2. Vandal-proof vent caps
3. Dielectric fittings
4. Pipe sleeves
5. Sleeve seals

2.5 BASIC SUPPORTS AND ANCHORS

A. General: Provide supports and anchors complying with Division-22 sections "Basic Plumbing Materials and Methods" and Hangers and Supports for Plumbing Piping and Equipment", in accordance with the following listing:

1. Adjustable swivel pipe rings for horizontal-piping hangers and supports.
2. Two-bolt riser clamps for vertical piping supports.
3. Concrete inserts, C-clamps, and steel brackets for building attachments.

2.6 SPECIAL VALVES

A. General: Special valves required for natural gas systems include the following types:

1. Gas Cocks:

a. Gas Cocks 2" (50 mm) and Smaller: 150 psi (1020 kPa) non-shock WOG, bronze straightway cock, flat or square head, threaded ends.
b. Gas Cocks 2-1/2" (65 mm) and Larger: 125 psi (850 kPa) non-shock WOG, iron body bronze mounted, straightway cock, square head, flanged ends.

2. Control Valves:

a. Master Gas Control Valve: Bronze body, packless, single seat, explosion-proof, solenoid operated, normally closed, UL approved, automatic reset, 120 volt.

2.7 PRESSURE REGULATING VALVES

A. General: Where required, provide single stage, steel jacketed, corrosion-resistant gas pressure regulators; with atmospheric vent, elevation compensator; with threaded ends for 2" (50 mm) and smaller, flanged ends for 2-1/2" (65 mm) and larger; for inlet and outlet gas pressures, specific gravity, and volume flow indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which natural gas systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division-22 sections "Basic Plumbing Materials and Methods" and "Identification for Plumbing Piping and Equipment".

3.3 INSTALLATION OF NATURAL GAS PIPING

A. General: Install natural gas piping in accordance with Division-22 sections "Basic Plumbing Materials and Methods" and "Pipe, Tube and Fittings for Plumbing Systems"; and in accordance with applicable codes and local Utility Company requirements.

1. Use sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.
2. Remove cutting and threading burrs before assembling piping.
3. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped or damaged.
4. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connections are completed.
5. Ground gas piping electrically and continuously within project, and bond tightly to grounding connection.
6. Install drip-legs in gas piping where indicated, and where required by regulation.
7. Install "Tee" fitting with bottom outlet plugged or capped, at bottom of pipe risers.
8. Use dielectric fittings where dissimilar metals are joined together.
9. Install piping with 1/64" per foot (1.3 mm per meter) (1/8%) downward slope in direction of flow.
10. Install piping parallel to other piping, but maintain minimum of 12" (300 mm) clearance between gas piping and steam or hydronic piping above 200°F (93°C).
11. Insulate gas piping exposed to freezing temperatures.
12. For piping underground beneath buildings, install in welded conduit. Extend conduit inside and terminate in accessible portion of building and seal. Extend conduit outside minimum of 4" (100 mm) from building, and vent above grade.
13. For piping running through ducts or air plenums, install in welded conduit, ventilated on both ends.
14. For risers running through concrete or asphalt, install through minimum 6" (150 mm) pipe sleeve. Fill annular space with gravel.
15. Install magnesium anodes for underground steel pipe, one 5-lb (2.3 L) anode for up to 100' (30 m) in length and one 5-lb (2.3 L) anode for each additional 100' (30 m).
16. Install magnesium anodes for each underground steel or malleable iron fitting, isolated between two (2) sections of plastic pipe; one 3-lb (1.4 L) anode for each fitting.

3.4 GAS SERVICE

A. General: Arrange with Utility Company to provide gas service to indicated location with shutoff at terminus. Consult with Utility as to extent of its work, costs, fees and permits involved. Pay such costs and fees; obtain permits.

1. Extend service pipe from Utility's terminus to inside building wall, under Utility's direction.

2. Provide shutoff in gas service pipe at entry in building, extend pipe to gas meter location indicated; provide parts and accessories required by Utility to connect meter.

3.5 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Division-22 sections "Basic Plumbing Materials and Methods" and "Piping Specialties for Plumbing Systems".

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Install supports and anchors in accordance with Division-22 sections "Basic Plumbing Materials and Methods" and "Hangers and Supports for Plumbing Piping and Equipment".

3.7 INSTALLATION OF VALVES

A. Gas Cocks: Provide at connection to gas train for each gas-fired equipment item; and on risers and branches where indicated.

1. Locate gas cocks where easily accessible, and where they will be protected from possible injury.

B. Control Valves: Install as indicated. Refer to Division-26 for wiring; not work of this section.

C. Pressure Regulating Valves: Install as required to reduce pressure to meet the requirements of each piece of equipment. Valve shall comply with utility requirements. Pipe atmospheric vent to outdoors, full size of outlet. Install gas shutoff valve upstream of each pressure regulating valve.

3.8 EQUIPMENT CONNECTIONS

A. General: Connect gas piping to each gas-fired equipment item, with drip leg, shutoff gas cock and pressure regulating valve. Comply with equipment manufacturer's instructions.

3.9 FIELD QUALITY CONTROL

A. Piping Tests: Inspect, test, and purge natural gas systems in accordance with NFPA 54, and local utility requirements.

3.10 ADJUSTING AND CLEANING

A. Cleaning and Inspecting: Clean and inspect natural gas systems in accordance with requirements of Division-22 sections "Basic Plumbing Materials and Methods" and "Pipe, Tube and Fittings for Plumbing Systems".

3.11 SPARE PARTS

A. Valve Wrenches: Furnish to the Owner, with receipt, two (2) valve wrenches for each type of gas valve installed, requiring same.

END OF SECTION 22 63 00

DIVISION 23 – HVAC

SECTION 23 01 00

BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

A. Unless otherwise modified, provisions of General Conditions, Supplementary Conditions and Division-01 govern work under the Mechanical Divisions.

B. Contract drawings for mechanical work are diagrammatic, intended to convey scope and general arrangement. All dimensions shall be verified prior to construction.

C. Refer questions involving document interpretation or discrepancies to Engineer for review and direction.

D. Correction of faulty work due to resolving discrepancies without authorization shall be the responsibility of the Contractor.

E. Should the Contractor discover any discrepancies or omissions on the drawings or in the specifications, he shall notify the Engineer of such conditions prior to the bid date. Otherwise, it will be understood that the drawings and specifications are clear as to what is intended and shall be as interpreted by the Engineer.

F. The complete set of Architectural, Structural, Civil, Mechanical, and Electrical drawings and specifications apply to this work.

1.2 SCOPE

A. The work in Division-23 includes furnishing and installing the mechanical systems complete and ready for satisfactory service.

B. Requirements specified govern work in all sections of Division-23.

1.3 REFERENCES

A. References to standards, codes, catalogs and recommendations are latest edition in effect on date of invitation to bid.

B. Refer to applicable contract drawings, specifications and addenda pertaining to other divisions for conditions affecting work.

C. Refer to Division-01 for description of alternates.

D. Refer to Division-01 for description of base bid items.

1.4 DEFINITIONS

A. Following are definitions of terms and expressions used in this Division:

1. "Approve" - to permit use of material, equipment or methods conditional upon compliance with contract document requirements.
2. "Concealed" - hidden from normal sight; includes work in crawl spaces, above ceilings, and in building shafts.
3. "Directed" - directed by Engineer.
4. "Ductwork" - includes ducts, fittings, housings, dampers, supports and accessories comprising a system.
5. "Equal, equivalent" - possessing the same performance qualities and characteristics and fulfilling the same utilitarian function.
6. "Exposed" - not concealed.
7. "Indicated" - indicated in Contract Documents.
8. "Piping" - includes pipe, fittings, valves, supports and accessories comprising a system.
9. "Provide" - furnish and install.
10. "Removable" - detachable from the structure or system without physical alteration of materials or equipment or disturbance to other construction.
11. "Review" - limited observation or checking to ascertain general conformance with design concepts and general compliance with contract document requirements. Such action does not constitute a waiver or alteration of the contract requirements. Verification of quantities and dimensions shall be the responsibility of the Contractor.
12. “Appurtenances” - a device or assembly installed in the referenced system which performs some useful referenced function in the operation, maintenance, servicing, economy or safety of the system. Some examples include, but are not limited to aerators, anchors, supports, gauges, backflow preventors, expansion tanks, filters, flow controls, heat exchangers, interceptors, meters, pressure reducing valves, relief valves, dampers, separators and similar devices.
13. “Record Documents” - drawings, plans and specifications that indicate the nature and location of work reported by Contractors, but not verified by Consultant. Record documents cannot be considered reliable; as they are based on information reported by the Contractor only and is not verified by the Architect or Engineer (A/E).

1.5 RIGGING REQUIREMENTS

A. Prior to bidding, the Contractor shall verify that all equipment can be physically rigged to the proposed location without disturbance or dismantling of any existing or new physical obstacles. Should the rigging of any new equipment appear to be an issue, the Contractor shall inform the Architect or Engineer (A/E) seven (7) days prior to the bid date that the rigging of the new equipment may present a problem. Otherwise, the Contractor shall, in accordance with the manufacturer’s approval and without voiding warranties and/or certifications, have the equipment “broken down” into sections as required to install the equipment in its proposed location without disturbance or dismantling of any existing or new physical obstacles.

B. Failure to inform the Architect or Engineer (A/E) seven (7) days prior to the bid of any rigging problems will result in the Contractor accepting full responsibility for all modifications to the equipment or the physical obstacles required to install the equipment in its proposed location without additional cost to the Owner.

1.6 CONTRACTOR'S INSTALLATION DRAWINGS

A. Prior to fabrication and installation, submit shop drawings (min. scale - 1/4" = 1' - 0") illustrating all ductwork, plumbing piping, lighting fixtures, cable tray, conduit, expansion loops, supports, alignment guides and fire protection coordinated with each other and with the structure. Installation drawings shall be reviewed by Owner's representative prior to fabrication and installation of any new work and prior to the ordering of any mechanical equipment.

B. Failure to comply with Paragraph 1.6, A shall result in the following:

1. The Contractor shall accept full and absolute responsibility for the coordination of all project materials and equipment to be installed as indicated on the contract documents.
2. Proposed change orders and/or time extensions will not be accepted for any additional work that results from coordination related changes.
3. A credit shall be issued to the Owner for the value of the coordinated installation drawings; the value of the credit to the Owner shall be as determined by the A/E.

C. Computer (CADD) files of mechanical drawings (HVAC, etc.) will be made available to the Contractor for use in the preparation of coordinated drawings, shop drawings or any other use.

1.7 MATERIAL, EQUIPMENT AND SUBSTITUTION REQUIREMENTS

A. Use products of one manufacturer where two or more items of same kind of equipment are required.

B. Materials and equipment shall have a record of two (2) years successful field use.

C. For certain items of equipment the specification is based upon the manufacturer's product. Other manufacturer’s names are listed. Contractor may purchase, conditional upon meeting project requirements, (i.e. space, structure and electrical requirements) equipment from the listed manufacturers.

D. Only manufacturer's equipment named on the drawings, upon which the specification is based, has been checked for this project. Contractor must check allocated space and structure for clearance suitability of equipment of alternate manufacturer including parts replacement and servicing.

E. Where the drawings and/or specifications indicate more than one allowable manufacturer for a particular piece of equipment and/or product, only those manufacturers indicated may submit products and services to be included in the work. Unless otherwise indicated, manufacturers other than those listed will not be acceptable.

F. Substitutions shall comply with Section 012500 and the requirements of this section. Substitution submittals shall include all information required in the “Submittals” paragraph of this specification section, as well as all other requirements indicated through the Division-23 specifications. Substitutions will not mitigate, in any way, the Contractor's responsibility in complying with the coordination, contract requirements or design intent. Any additional electrical, structural or special requirements, etc. shall be the responsibility of the

Contractor. Also, any additional cost incurred as a result of substitution shall be the responsibility of the Contractor.

G. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.8 MATERIAL AND EQUIPMENT LIST

A. Within thirty (30) days after award of the contract, submit for Engineer's review a list of subcontractors' and manufacturers' names for items proposed for this project.

1.9 SUBMITTALS

A. Where the drawings and/or specifications indicate more than one allowable manufacturer for a particular piece of equipment and/or product, only those manufacturers indicated may submit products and services to be included in the work. Unless otherwise indicated, manufacturers other than those listed will not be acceptable.

B. Submit shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review.

C. Shop Drawings: Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment. Include equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted. All equipment and/or products shall be submitted by an authorized factory representative of that particular product.

D. Manufacturer's Data: Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.

E. Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), American Gas Association (AGA), American Refrigeration Institute (ARI), and Underwriters' Laboratories (UL), proof of such conformance shall be submitted to the Engineer for review. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be

acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable testing. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for review. The certificate shall identify the manufacturer, the product, and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the referenced standards listed.

F. Contractor shall thoroughly review and stamp all submittals to indicate compliance with contract requirements prior to submission and coordinate installation requirements for equipment submitted, including a) the verification of equipment weights relative to the new structural support system and b) the verification of equipment dimensions relative to new architectural conditions. Contractor shall be responsible for correctness of all submittals.

G. Compliance Review Form: Each equipment submittal must include a Compliance Review Form formatted as follows:

1. Section 1: Certify that the submittal is in complete compliance with the plans and specifications, except for the numbered and footnoted deviations and exceptions as defined herein. Deviations or exceptions taken in a cover letter or by contradiction or omission shall not constitute a release from the requirement that the equipment be in complete compliance with the plans and specifications.
2. Section 2: Provide a detailed paragraph by paragraph annotation of the specification with an individual “C”, “D”, or “E” noted in the margin, as follows:

    a. “C” shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
    b. “D” shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.
    c. “E” shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

H. Electronic Submittals: Should the contractor elect to submit electronic shop drawings/submittals, the procedure shall be as follows:

1. Provide a transmittal with the electronic shop drawing/submittal indicating that the document was transmitted electronically. Transmittal shall also include verification of the contractor’s review indicating compliance with the contract documents in accordance with paragraph 1.09.F of this section.
2. Sequentially number all pages on the electronic shop drawing/submittal. The total number of pages shall be reflected in the transmittal.

3. Submittal review comments shall be transmitted electronically. Large documents will be scanned with comments as necessary and returned electronically.
4. All shop drawings such as, but not limited to: coordination drawings, ductwork shop drawings, fire alarm drawings, ductbank layouts, etc. shall be submitted in hard copy, full size format.
5. Provide hard copy of the shop drawing/submittal for each of the Operations and Maintenance Manuals.
6. Failure to comply with the above will result in the submittal being returned and marked "Not Reviewed".

I. Submittals will be reviewed for general compliance with design concept in accordance with contract documents. Dimensions, quantities, weights, or other details will not be verified by the A/E; this is the responsibility of the Contractor.

J. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted.

K. Review Period: BKM shall be allotted two (2) weeks for the processing, review and return of all submittals. It shall be incumbent upon the Contractor to include this time period in their schedule.

1. Resubmittals: BKM shall be allotted an additional two weeks (14 days) for the review of each resubmittal. Again, it shall be the Contractor's responsibility to submit the appropriate materials in a timely fashion.
2. Contract Extension: No extension in contract time will be authorized as a result of the timeline addressed above.

L. Submittal Identifications:

1. Place a permanent label or title block on each submittal for identification.
2. Indicate name of firm or entity that prepared each submittal on label or title block.
3. Provide a space approximately 4 by 5 inches on label or beside title block to record contractor's review and approval markings and action taken by A/E.
4. Include the following information on label for processing and recording action taken:

a. Project name
b. Date
c. Name and address of A/E
d. Name and address of contractor
e. Name and address of subcontractor
f. Name and address of supplier
g. Name of manufacturer
h. Unique identifier, including revision number
i. Number and title of appropriate specification section
j. Drawing number and detail references, as appropriate
k. Other necessary identification
l. Example: 230700-01-0

- 230700 references the spec section
- 01 indicates this is the first submittal from this spec section
- 0 indicates this is the original submittal (where 1 would indicate this is the first re-submittal)

M. The engineer will provide a maximum of two (2) submittal reviews per equipment submittal; the initial review plus one (1) re-submittal. Should the re-submittal be returned “Not Acceptable” or “Revise and Resubmit”, the contractor shall provide the exact manufacturer and model indicated in the contract documents as the basis of design. In addition, the contractor shall accept complete responsibility for all delays resulting from the submittal review process extending beyond two (2) reviews per equipment submittal.

N. Resubmittals: Resubmittals shall comply with paragraph 1.09 of this section and the following additional requirements.

1. Resubmittals shall include a written response to each submittal comment. Provide a detailed comment by comment annotation of the submittal review comments with an individual “C”, “D”, or “E” as follows:

a. “C” shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
b. “D” shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.
c. “E” shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

1.10 MANUFACTURER'S RECOMMENDATIONS

A. Installation procedures are required to be in accordance with the recommendations of the manufacturer of the material being installed.

1.11 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

1.12 SAFETY REQUIREMENTS

A. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded in accordance with OSHA. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified herein. Items such as catwalks, ladders, and guardrails shall be provided where required for safe operation and maintenance of equipment.

1.13 WORKMANSHIP

A. Remove and replace, at no extra cost, all work not orderly, reasonably neat, or workmanlike.

B. Coordinate all work and cooperate with other trades to facilitate execution of work.

1.14 REGULATIONS AND PERMITS

A. Comply with all applicable codes and regulations.

B. All equipment provided shall be in accordance with all applicable local, state, and federal codes, guidelines and standards, as well as the authority having jurisdiction. Equipment and installation shall be in compliance with all applicable energy codes including the most current version of ASHRAE Standard 90.1.

C. Obtain and pay for all required permits.

1.15 CUTTING AND PATCHING

A. Unless otherwise directed, do all cutting and patching. Damaged work, including fireproofing and waterproofing shall be repaired by skilled mechanics of the trade involved.

B. Do not cut walls, floors, roofs, reinforced concrete or structural steel without structural Engineer's permission. Install services without affecting reinforcing steel.

1.16 LINTELS

A. Under this Section provide all lintels not provided elsewhere which are required for openings for the installations of mechanical work. Lintels shall meet the requirements of the structural sections.

1.17 CLEANING UP

A. Keep premises free from accumulation of debris.

B. Remove tools, scaffolding, surplus material, debris, and leave premises broom clean.

C. On discontinuance of part of the work, place all debris in containers and promptly remove them from the Owner's property.

D. Leave all areas broom clean.

E. Final clean-up shall be performed.

1.18 AREAS REQUIRING SPECIAL FINISHES/PAINTING

A. Refer to the Architectural division for painting requirements including all exposed and uninsulated piping including valves, traps, strainers and appurtenant items; and exposed electrical work including conduit, boxes, switches starters and disconnects in kitchens, cafeterias, dining rooms, serving pantries and utility rooms. Finish shall not be applied to nameplates, pushbuttons. Stainless steel housing and plates require no plating or paints.

1.19 PROTECTION

A. Protect mechanical and electrical material and equipment from the elements or other injury as soon as delivered on premises.

B. Cap or plug openings in equipment, piping, duct, and conduit systems to exclude dirt and other foreign material. Rags, wool, cotton, paper, waste or similar materials shall not be used for plugging.

C. Unless approved by Owner, HVAC equipment shall not be used for temporary heating or ventilation during construction.

D. Contractor shall provide temporary cooling and heating as required to protect all construction materials from the potential adverse effects of high or low temperature and humidity. Upon delivery of ceiling and other finish materials to a location within the building, environmental conditions in all spaces where the materials will be either stored or installed shall be permanently maintained at 75°F (±2°F) and 50% RH (±5%). Should the HVAC include a reheat system, the reheat system shall be energized to provide temperature and humidity control whenever the HVAC system is energized. Contractor shall pay for all utility, fuel, operational, maintenance and repair costs associated with providing the environmental conditions indicated above until the owner accepts occupancy of the building.

1.20 CLEANING OF SYSTEMS

A. After satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers and other accessory items, thoroughly clean all systems. Blow out and flush piping until interiors are free of foreign matter.

B. Flush piping in recirculating water systems to remove all cutting oil, excess pipe joint compound and other foreign materials. Furnish necessary temporary pumping equipment to thoroughly clean the water piping. Do not use any system pump until after cleaning and flushing has been accomplished to the satisfaction of the Engineer. Employ chemical cleaners, including a non-foaming detergent, not harmful to system components. After cleaning operation, final flushing and refilling the residual alkalinity shall not exceed 300 parts per million. Work shall be performed or supervised by a qualified water treatment service company with personnel skilled in the safe and proper use of chemicals and in testing procedures. After completion, submit a certificate of completion to Engineer stating name of the service company used.

C. Leave strainers and dirt pockets in clean condition.

D. Clean fans, ductwork, enclosures, flues, registers, grilles and diffusers at completion of work. Vacuum or swab clean low pressure ducts and outlets supplying exam rooms.

E. Permanent air systems operated for temporary heating during construction shall only be operated with filters installed of equal efficiency to those specified. Prior to acceptance and after cleaning of system, replace with clean filters as specified. Return air openings shall be equipped with filter cloth to protect against debris entering the ductwork.

1. If upon periodic inspection, it is determined that the permanent ductwork has become contaminated with construction debris, then the contractor shall be required to procure the services of a professional duct cleaning agency prior to substantial completion, at no additional cost to the Owner.

F. Should any system become clogged with construction refuse after acceptance, the contractor shall pay for all labor and materials required to locate and remove the obstruction and replace and repair work disturbed.

G. Leave all systems clean, and in complete running order.

H. Equipment that has been subjected to the elements shall be cleaned of all rust, dirt and debris and repainted to match original finish.

1.21 COMMISSIONING TESTS, VERIFICATION AND FINAL REPORT

A. General: In addition to the tests required during and after installation of automatic control systems, the Contractor shall perform commissioning tests to verify that the entire automatic control systems are designed, installed, and adjusted to perform as required in the Contract.

B. Verify proper operation of each and every control sequence indicated on the drawings and in the specifications.

C. Verification of Electronic Controllers:

1. Verify the operation of the field panels. Demonstrate proper automatic restart of equipment after power restoration.
2. Verify each and every required control application.
3. Verify the operation of the clock routine in the field panel.
4. Demonstrate proper system operation while setpoints and data are being modified.

D. The complete verification of each control function shall be included in a final test report and the operations and maintenance manuals. Verification of each control function shall include an itemized list of all mechanical equipment and associated control device, the date of the verification and the initials of the individuals who verified the proper operation of the control function. At a minimum, two individuals, the balance contractor and the control manufacturer, shall perform, witness and verify the proper operation of each control function indicated on the drawings and/or specifications from central plant source equipment (chillers, boilers, air handling units, pumps, etc.) to each room control function (thermostat, control of VAV damper, reheat and/or radiation valve, etc.). Prior to the verification process, the Owner shall be given the option to provide

representative(s) to witness the verification of any or all equipment/control functions.

E. Upon completion of all field functional tests, the controls manufacturer shall demonstrate to the owner similar tests via the energy management/building automation system and computer graphics.

F. Failure of Tests: If any test, verification, or demonstration fails to meet the specification requirements, the component of the automatic control system causing the control system failure, be it hardware, firmware or software, shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall be repeated.

G. Test Report: Upon satisfactory tests of the automatic control systems, a copy of final test results shall be bound in the operations and maintenance manual.

1.22 OPERATING AND MAINTENANCE MANUAL

A. Submit Operation and Maintenance Manuals in compliance with Section 017823, other applicable sections and the requirements of this paragraph.

B. At a minimum, the manual shall contain the following:

1. Title page
2. Table of contents
3. Contractor and sub-contractor contact information
4. Supplier contact information for all mechanical equipment
5. Copies of manufacturer's and contractor's warranty information (project and equipment) for all mechanical equipment.
6. Submittal log for all mechanical equipment
7. One (1) reviewed copy of each shop drawing or submittal incorporating all A/E and owner submittal review comments.
8. Copy of inspector acceptance certificates / documents.
9. Provide an 11 x 17 fold-out drawing of each floor plan and indicate locations of the following:

    a. System shutoff valves
    b. Fire/smoke dampers

10. All duct, pipe and equipment pressure test reports complete with 11 x 17 fold-out drawing, indicating all systems tested.
11. Final Test and Balance (TAB) Reports. Do not include reports that have not been accepted by the A/E. Pencil or partial copies will not be acceptable.
12. Maintenance procedures for each item of mechanical equipment to include frequency and type of maintenance, spare parts and attic/stock list. This shall include the manufacturer's literature indicating operating and maintenance instructions, parts list, illustrations and diagrams.
13. Valve tag chart
14. Commissioning, system verification and functional performance test results.

1.23 TOOLS AND LUBRICANTS

A. Furnish and turn over to the Owner, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Owner.

D. Lubricants: A minimum of one quart (.9 L) of oil, and one pound (450 g) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

1.24 FIELD INSTRUCTION

A. Upon completion of work, instruct Owner's representative in the proper operation and maintenance of the mechanical and electrical systems in accordance with Section 017900, Demonstration and Testing, and the requirements of this section.

B. Instruction periods specified below shall be in addition to instruction specified for certain items elsewhere in the specifications.

C. Instructions shall be given by persons expert in the following systems and equipment and shall include descriptions and demonstration of procedures, data logging, and analysis.

1. Heating Plant - including boilers, heat exchangers, fuel supply, burners, pumps, related equipment, water treatment, combustion testing, safety controls. Provide 16 hours of instruction.
2. Cooling Plant - Including refrigeration plant, pumps, related equipment, water treatment, safety controls. Provide 16 hours of instruction.
3. Air Systems - Including air handling units, heating and cooling coils, filters, fans, safety controls and other air handling equipment. Provide 24 hours of instruction.
4. Automatic Control - Including operating controls for all heating, cooling, ventilating systems, control centers, panels, Provide 24 hours of instruction.
5. General Instructions - Including review of written operating instructions and balancing report, miscellaneous instructions. Provide 16 hours of instruction.

1.25 RECORD DOCUMENTS

A. The Contractor shall maintain a record set of mechanical prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.

B. A separate set of neat, legible mechanical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner's Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections

C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in electronic CADD format. One (1) set of full size prints, one (1) CD of the electronic CADD drawings (in AutoCad and pdf format), along with the red-lined marked up field set shall be delivered to the owner upon completion. If requested, the electronic CADD documents shall be up-loaded to the owner's FTP site. The final CADD documents shall indicate in the title or revision block "RECORD DOCUMENTS" along with the date completed. The electronic format shall be compatible with the owner's preferred version of AutoCad. Coordinate with the owner before producing the CD or up-loading to the FTP site.

D. Computer (CADD) files of mechanical drawings will be made available to the Contractor upon receipt of a signed waiver (available upon request). One CD will be made available to the general contractor or construction manager for distribution to the trades.

E. Should the Contractor's electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

1.26 LEED CERTIFICATION

A. This project is required to obtain a LEED certification. The Contractor shall provide all required LEED documentation as required to achieve the construction related LEED credits.

B. The project includes both LEED Fundamental and Enhanced Commissioning. Provide all services as required for compliance with the Fundamental and Enhanced Commissioning requirements. Coordinate with the Commissioning Agent as required. Refer to the Commissioning specification sections for additional information.

1.27 GUARANTEE/WARRANTY

A. Each Contractor shall furnish a guarantee covering all labor and materials furnished by him for a period of two (2) years from the date of final acceptance of his work, and he shall agree to repair and make good at his own expense any and all defects which may appear in his work during that time if, in the judgment of the Engineer, such defects arise from defective workmanship and/or imperfect or inferior material.

B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of guarantee shall be delivered to the Owner.

C. Within the two (2) year warranty/guarantee period, manufacturer's recommended maintenance shall be provided by the Contractor.

D. In addition to the warranties indicated above, provide a five (5) year parts and labor warranty for each of the following:

1. Chillers
2. All air conditioning unit related compressors (i.e. rooftop DX units, all air cooled condensing units, split system units, etc.).

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

Not Applicable

END OF SECTION 23 01 00

SECTION 23 02 00

PROJECT CLOSEOUT - HVAC

PART 1 – GENERAL

1.1 SUMMARY

A. This section provides a summary of the primary mechanical project closeout activities, however, this section does not attempt to address all project closeout requirements. Closeout activities referenced in this section include the following:

1. Pressure Testing
2. Start-up
3. Punch-out Procedures
4. Testing, Adjusting and Balancing
5. Commissioning and System Verification
6. Operation and Maintenance Manuals (O & M Manuals)
7. Demonstration and Training
8. Record Documents
9. Close-out Documents

B. This Section shall not supersede any other close-out section or requirements of the Contract. Refer to other Divisions of the specifications and the General Requirements of the Contract for further instructions.

PART 2 – PRODUCTS

Not Applicable

PART 3 – EXECUTION

3.1 PRESSURE TESTING

A. Piping: The Contractor shall perform pressure testing on all piping systems as indicated in Division-23 section “Testing, Adjusting and Balancing”, and elsewhere as indicated.

B. Ductwork: The Contractor shall perform pressure testing on all ductwork systems as indicated in Division-23 sections, “Testing, Adjusting and Balancing”, “Low Pressure Ductwork” and “High Pressure Ductwork” and elsewhere as indicated.

C. Air Handling Units: The Contractor shall perform factory and / or field pressure testing on all air handling units where required by the drawings or specifications.

D. Final pressure test results shall be submitted as a separate project submittal for review and included with the Test and Balance Report. Upon review for general conformance, include all pressure tests in the O & M Manual.

E. All factory performed equipment test results shall be included in the final O & M Manuals.

F. Where re-tests were required, indicate remedial action taken and submit in test report.

3.2 START-UP

A. The Contractor shall perform start-up on each piece of mechanical equipment as specified in each section of Division-23.

B. Where indicated in each section of Division-23, the services of a factory authorized and certified technician shall be required to perform the equipment start-up. Start-up by any other organization other than as required by the manufacturer is unacceptable.

C. Start-up reports shall be provided for all equipment and be included in the final O & M Manuals.

3.3 PUNCH-OUT PROCEDURES

A. Preliminary Punch-out:

1. Prior to requesting an inspection from the Owner, Engineer, or Permit Official, the General Contractor or Construction Manager (GC or CM) shall provide a preliminary punch-out of the area in question.
2. Once completed, their punch list shall be supplied to each trade for corrections and completion. The punch list shall also be provided to the Engineer for their use.
3. Upon being informed that the trade contractors have addressed all of the outstanding items, the GC / CM shall backcheck the work and update the punch list.

B. Final Punch-out:

1. Final punch-out by the engineer shall not commence until the GC or CM has exhausted their review and has signed off on all items.
2. A copy of the sign-off shall be provided to the Engineer for their record.
3. Once the above has been completed, the Engineer shall be notified that the work is substantially complete and ready for a final punch-out.
4. Depending on the size, schedule, and project complexity, punch-outs may be requested for specific areas or systems, rather than the facility as a whole. Examples of specific requests include the following:

    a. Above ceiling
    b. Mock-ups for any repetitive installation to confirm acceptance prior to continuing (exam rooms, etc.)
    c. Equipment rooms

3.4 TESTING, ADJUSTING AND BALANCING

A. Comply with all provisions of Division-23 Section, “Testing, Adjusting and Balancing” (TAB) for the systems listed, but not limited to, the following:

1. Building Automated Systems
2. Fans
3. Air Handling Units
4. Ductwork Systems
5. Pumps
6. Chillers
7. Coils
8. Boilers
9. Piping Systems
10. Terminal Units
11. Heat Exchangers

B. TAB reports shall be submitted as a separate project submittal for review. Upon review for general conformance, include the final TAB report in the O & M Manual.

C. Comply with testing, adjusting and balancing requirements as indicated in each section within Division-23.

3.5 COMMISSIONING AND SYSTEMS VERIFICATION

A. The Contractor shall perform commissioning and system verification tests to verify that all mechanical systems are functionally performing in accordance with the Contract Documents.

B. Comply with all applicable sections of Division 1 and Division-23 to include, but not be limited to, “Basic HVAC Requirements”, “Testing, Adjusting and Balancing”, “Automatic Temperature Controls” and “Commissioning”, where applicable.

C. Prepare a check list and submit for review a list of all system verification and functional performance tests to be performed for each mechanical system.

D. Any system or component failure shall be repaired or replaced and re-tested until test is successfully completed.

E. Upon satisfactory completion of the commissioning and system verification, all test reports shall be submitted for review. Final report shall be included in the O & M Manuals.

3.6 OPERATION AND MAINTENANCE MANUALS

A. Provide in accordance with Division 1 and Section 230100.

B. The O & M Manuals shall be submitted to the A/E for review of general conformance.

3.7 DEMONSTRATION AND TRAINING

A. Provide in accordance with Section 017900 and 230100.

3.8 RECORD DOCUMENTS

A. Provide in accordance with Section 017839, Project Record Documents, and Section 230100.

3.9 CLOSEOUT DOCUMENTS

A. Prior to Substantial Completion and /or Final Payment, the Contractor shall prepare and submit the following:

1. Final punch lists indicating completion of all items
2. All record drawings
3. All record specifications
4. Operation and Maintenance Manuals
5. Complete final cleaning
6. Remove temporary facilities and complete site restoration

END OF SECTION 23 02 00

SECTION 23 05 00

BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this Section.

B. Requirements specified in Division-23 Section "Basic HVAC Requirements" apply to this Section.

1.2 SUMMARY

A. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:

1. Mechanical equipment nameplate data.
2. Firestopping: Provide seals for all openings through fire-rated walls, floors, or ceilings used as passage for mechanical and electrical components such as piping, ductwork, conduit, etc.
3. Excavation for underground utilities and services, including underground piping (under the building and from building to utility connection), and equipment up to five (5) feet (1500 mm) outside the building.
4. Miscellaneous metals for support of mechanical materials and equipment.
5. Wood grounds, nailers, blocking, fasteners, and anchorage for support of mechanical materials and equipment.
6. Joint sealers for sealing around mechanical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.
7. Access panels and doors in walls, ceilings, and floors for access to mechanical materials and equipment.

1.3 DEFINITIONS

A. The following definitions apply to excavation operations:

1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
2. Subbase: As used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.
3. Subgrade: As used in this Section refers to the compacted soil immediately below the slab or pavement system.

4. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect.

B. The following definitions apply to firestopping:

1. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.
2. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.
3. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gases and smoke.
4. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.
5. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.
6. System: Specific products and applications classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.
7. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.4 SUBMITTALS

A. Firestopping: Refer to architectural divisions for requirements.

B. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for mechanical materials and equipment.

C. Coordination drawings for access panel and door locations in accordance with Division-23 sections.

D. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer for the installation and application of joint sealers, access panels and doors, and firestopping materials with at least two years' experience with installations.

B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

C. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

1. Provide UL Label on each fire-rated access door.

D. Local and State Regulatory Requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL firestop system numbers, or UL classified devices.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

1.7 PROJECT CONDITIONS

A. Conditions Affecting Excavations: The following project conditions apply:

1. Uncharted or Incorrectly Charted Utilities: Contact utility owner immediately for instructions.
2. Provide temporary utility services to affected areas. Provide minimum of 48-hour notice to Architect prior to utility interruption.
3. Use of explosives is not permitted.

B. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

PART 2 - PRODUCTS

2.1 MECHANICAL EQUIPMENT NAMEPLATE DATA

A. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.2 FIRESTOPPING

A. All penetrations through fire barriers shall be firestopped in accordance with Section 078413, Penetration Firestopping.

2.3 SMOKE STOPPING

A. All penetrations through smoke barriers, smoke partitions, or any other surface required to resist the passage of smoke shall be provided in accordance with Section 078443, Joint Firestopping.

2.4 SOIL MATERIALS

A. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.

B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch (40 mm) sieve, and not more than 5 percent passing a No. 4 sieve.

C. Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock, or gravel larger than 2 inches (150 mm) in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

2.5 MISCELLANEOUS METALS

A. Steel plates, shapes, bars, and bar grating: ASTM A 36.

B. Cold-Formed Steel Tubing: ASTM A 500.

C. Hot-Rolled Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Schedule 40, welded.

E. Non-shrink, Non-metallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout, recommended for interior and exterior applications.

F. Fasteners: Zinc-coated, type, grade, and class as required.

2.6 MISCELLANEOUS LUMBER

A. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPA rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.

B. Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 15/32 inches (12 mm).

2.7 JOINT SEALERS

A. General: Provide in accordance with architectural divisions.

2.8 ACCESS DOORS

A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces. Access doors in Toilet Rooms, showers, and other wet areas shall be stainless steel.

B. Frames: 16-gage (1.6 mm) steel, with a 1-inch (25 mm) wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.

1. For Installation in Masonry, Concrete, Ceramic Tile, or Wood Paneling: 1-inch (25 mm) wide exposed perimeter flange and adjustable metal masonry anchors.
2. For Gypsum Wallboard or Plaster: Perforated flanges with wallboard bead.
3. For Full-Bed Plaster Applications: Galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

C. Flush Panel Doors: 14-gage (2 mm) sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees (3.05 Radians); factory-applied prime paint.

1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

D. Locking Devices: At all locations, provide 5-pin or 5-disc type cylinder locks, individually keyed; provide two (2) keys. Coordinate with Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FIRESTOP INSTALLATION

A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction and the requirements of Sections 078413 and 078443.

3.3 PREPARATION FOR JOINT SEALERS

A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.

B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers,

using masking tape. Remove tape immediately after tooling without disturbing joint seal.

3.4 EXCAVATION

A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.

B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.

1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches (750 mm) below finished grade elevation.

C. Install sediment and erosion control measures in accordance with local codes and ordinances.

D. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

E. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.

F. Trenching: Excavate trenches for mechanical installations as follows:

1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches (150 to 225 mm) clearance on both sides of pipe and equipment.
2. Excavate trenches to depth indicated or required for piping to establish indicated slope and invert elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.
3. Limit the length of open trench to that in which pipe can be installed, tested, and the trench backfilled within the same day.
4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of pipe. Provide a minimum of 6 inches (150 mm) of stone or gravel cushion between rock bearing surface and pipe.
5. Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment on undisturbed soil.

6. For pipes or equipment 6 inches (150 mm) or larger in nominal size, shape bottom of trench to fit bottom 1/4 of the circumference. Fill unevenness with tamped sand backfill. At each pipe joint over-excavate to relieve the bell or pipe joint of the pipe of loads, and to ensure continuous bearing of the pipe barrel on the bearing surface.

G. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F (2 degrees C).

H. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.

1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
2. Under building slabs, use drainage fill materials.
3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
4. For piping less than 30 inches (750 mm) below surface of roadways, provide 4-inch (100 mm) thick concrete base slab support. After installation and testing of piping, provide a 4-inch (100 mm) thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
5. In other areas, use excavated or borrowed materials.

I. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Inspection, testing, approval, and locations of underground utilities have been recorded.
2. Removal of concrete formwork.
3. Removal of shoring and bracing, and backfilling of voids.
4. Removal of trash and debris.

J. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches (200 mm) in loose depth for material compacted by heavy equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

K. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

L. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them approximately to same elevation in each lift.

M. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.

1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils),

determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

2. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches (300 mm) of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
3. Areas Under Walkways: Compact top 6 inches (150 mm) of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
4. Other Areas: Compact top 6 inches (150 mm) of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
5. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.

N. Subsidence: Where subsidence occurs at mechanical installation excavations during the period twelve (12) months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.7 APPLICATION OF JOINT SEALERS

A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
2. Comply with recommendations of ASTM C 790 for use of acrylic - emulsion joint sealants.

B. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.8 INSTALLATION OF ACCESS DOORS

A. Provide access doors (minimum 18" x 18") as required to provide maintainable access to all mechanical equipment including, but not limited to, valves, dampers, air terminals, etc.

B. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

C. Adjust hardware and panels after installation for proper operation.

END OF SECTION 23 05 00

SECTION 23 05 13

ELECTRICAL PROVISIONS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of electrical provisions to be provided as mechanical work is indicated in all other Division-23 sections, on drawings, and as further specified in this section.

B. Types of work normally recognized as electrical, but provided as mechanical, specified or partially specified in this section, include but are not necessarily limited to the following:

1. Motors for mechanical equipment.
2. Starters for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical-electrical devices provided for mechanical systems, to equipment control panels.
5. Electrical heating coils and similar elements in mechanical equipment.

C. Refer to requirements of Division-26 sections.

1.2 QUALITY ASSURANCE

A. Coordination with Electrical Work: Wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in Division-26 sections for electrical work of this section which is not otherwise specified.

B. Standards: For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology herein. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.3 SUBMITTALS

A. Listing, Motors of Mechanical Work: Concurrently, with submittal of mechanical products listing (Basic Mechanical and Division-01 requirements), submit separate listing showing rating, power characteristics, application (connected equipment), and general location of every motor to be provided with mechanical work. Submit updated information promptly when and if initial data is revised.

1. Include in listing of motors, notations of whether motor starter is furnished or installed integrally with motor or equipment containing motor.

PART 2 - PRODUCTS

2.1 MOTORS

A. Motor Characteristics: Except where more stringent requirements are indicated, and except where required item of mechanical equipment cannot be obtained with fully complying motor, comply with the following requirements for motors of mechanical work:

B. Temperature Rating: Rated for 113 degrees F (40 degrees C) environment with maximum 122 degrees F (50 degrees C) temperature rise for continuous duty at full-load (Class B Insulation).

C. Starting Capability: Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than five (5) starts per hour for manually controlled motors.

D. Phases and Current Characteristics: Provide squirrel cage induction polyphase motors for 1/2 hp (.4 kW) and larger, and provide capacitor-start single-phase motors for 1/3 hp (.25 kW) and smaller, except 1/6 hp (.1 kW) and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division-26 sections, and with individual equipment requirements specified in other Division-23 requirements. For 2-speed motors provide two (2) separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

E. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.

F. Motor Construction: Provide general purpose, continuous duty motors, Class F insulation, Design "B" except "C" where required for high starting torque.

1. Bearings: Ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is normally inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual sections of Division-23 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
2. Enclosure Type: Except as otherwise indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division-23 for other enclosure requirements.
3. Overload Protection: Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
4. Noise Rating: Provide industry standard "Quiet" rating on motors.
5. Efficiency: For motors 1 horsepower (.7 kW) or higher, provide motors with minimum efficiencies as follows in accordance with IEEE Standard 112, Test Method B:

a. Open Motors (ODP)

MOTOR HP (KW)		MINIMUM EFFICIENCY *		
		1200 RPM	1800 RPM	3600 RPM
1	(.7)	82.5%	85.5%	77.0%
1.5	(1.1)	86.5%	86.5%	84.0%
2	(1.5)	87.5%	86.5%	85.5%
3	(2.2)	88.5%	89.5%	85.5%
5	(4)	89.5%	89.5%	86.5%
7.5	(5.6)	90.2%	91.0%	88.5%
10	(8)	91.7%	91.7%	89.5%
15	(11)	91.7%	93.0%	90.2%
20	(15)	92.4%	93.0%	91.0%
25	(19)	93.0%	93.6%	91.7%
30	(22)	93.6%	94.1%	91.7%
40	(30)	94.1%	94.1%	92.4%
50	(38)	94.1%	94.5%	93.0%
60	(45)	94.5%	95.0%	93.6%
75	(56)	94.5%	95.0%	93.6%
100	(75)	95.0%	95.4%	93.6%
125	(94)	95.0%	95.4%	94.1%
150	(115)	95.4%	95.8%	94.1%
200	(150)	95.4%	95.8%	95.0%

* Required Full Load Nominal Efficiency shall be in accordance with EISA 2007. Where efficiency listed above is higher than the EISA 2007 requirement, provide the higher efficiency indicated.

b. Enclosed Motors (TEFC)

MOTOR HP (KW)		MINIMUM EFFICIENCY *		
		1200 RPM	1800 RPM	3600 RPM
1	(.7)	82.5%	85.5%	77.0%
1.5	(1.1)	87.5%	86.5%	84.0%
2	(1.5)	88.5%	86.5%	85.5%
3	(2.2)	89.5%	89.5%	86.5%
5	(4)	89.5%	89.5%	88.5%
7.5	(5.6)	91.0%	91.7%	89.5%
10	(8)	91.0%	91.7%	90.2%
15	(11)	91.7%	92.4%	91.0%
20	(15)	91.7%	93.0%	91.0%
25	(19)	93.0%	93.6%	91.7%
30	(22)	93.0%	93.6%	91.7%
40	(30)	94.1%	94.1%	92.4%
50	(38)	94.1%	94.5%	93.0%
60	(45)	94.5%	95.0%	93.6%
75	(56)	94.5%	95.4%	93.6%
100	(75)	95.0%	95.4%	94.1%
125	(94)	95.0%	95.4%	95.0%
150	(115)	95.8%	95.8%	95.0%
200	(150)	95.8%	96.2%	95.4%

* Required Full Load Nominal Efficiency shall be in accordance with EISA 2007. Where efficiency listed above is higher than the EISA 2007 requirement, provide the higher efficiency indicated.

c. Where fan or pump motors are used in conjunction with, or controlled by, a variable frequency drive (VFD), motors shall be suitable for VFD operation (inverter duty motors).

d. For motors less than 1 horsepower (.7 kW), provide motors with higher efficiency than "average standard industry motors," in accordance with IEEE Standard 112, test method B.

G. Nameplate: Provide metal nameplate on each motor, indicating full identification of manufacturer, ratings, characteristics, construction, special feature and similar information.

H. Motor Modifications: In cases where the equipment submitted requires additional motors and/or controls, circuiting and related equipment shall be provided as approved and in accordance with the National Electrical Code. All costs relative to these electrical changes shall be included under the Section in which the equipment is furnished and installed and shall be coordinated with the electrical work at no expense to the Owner.

I. Power Factor: All motors one (1) horsepower and above shall have a minimum power factor of 0.90.

J. All motors operated on variable frequency drives shall be equipped with a maintenance free, conductive microfiber, shaft grounding ring with a minimum of two (2) rows of circumferential microfibers to discharge electrical shaft currents within the motor and/or its bearings. Motors up to 100 HP shall be provided with a minimum of one (1) shaft grounding ring installed either on the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor pump manufacturer or contractor and shall be installed in accordance with the manufacturer’s recommendations.

2.2 MECHANICAL EQUIPMENT

A. Electrical Heating Elements: Where electrical resistance coils and other heating elements are included in mechanical equipment or otherwise indicated as mechanical work, and except as otherwise indicated, provide 120-volt units where rating is less than 2 kW, higher-voltage single phase units where rating is 2 kW but less than 5 kW, and higher-voltage 3-phase units where rating is 5 kW and greater.

B. All mechanical equipment shall be approved and listed by Underwriters' Laboratories (UL) and shall bear nameplate indicating same.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 hp (.25 kW) and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Deliver starters and wiring devices which have not been factory installed on equipment unit to electrical Installer for installation.

C. Install furnished under Division-26 starter panels and wiring devices at locations indicated, securely supported and anchored, and in accordance with manufacturer's installation instructions. Locate in accordance with National Electric Code for installation requirements.

END OF SECTION 23 05 13

SECTION 23 05 14

PIPE, TUBE AND FITTINGS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in all other Division-23 sections.

B. Types of pipes and pipe fittings specified in this section include the following:

1. Steel Pipes
2. Copper Tube
3. Cast-Iron Pressure Pipes
4. Miscellaneous Piping Materials/Products

C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.

   a. Certify welding of piping work using the Standard Procedure Specifications by, and welders tested under supervision of, National Certified Pipe Welding Bureau (NCPWB).

2. Brazing: Certify brazing procedures, brazers and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of pipe and pipe fitting. In addition, submit a matrix indicating each service and the proposed pipe material and fitting.

B. Welding Certifications: Submit reports as required for piping work.

C. Brazing Certifications: Submit reports as required for piping work.

D. Maintenance Data: Submit maintenance data and parts lists for each type or mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division-01.

1.4 DELIVERY, STORAGE AND HANDLING

A. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage, and eliminate dirt and moisture from inside of pipe and tube.

B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.

C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.1 GENERAL

A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service; where type, grade or class is not indicated. Provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.

B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.2 STEEL PIPES AND PIPE FITTINGS

A. Black Steel Pipe: ASTM A 53, A 106 or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.

B. Galvanized Steel Pipe: ASTM A 53 or A 120; except comply with ASTM A 53 where close coiling or bending is required.

C. Seamless Steel Pipe: ASTM A 53, A 106, or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.

D. Galvanized Seamless Steel Pipe: ASTM A 53 or A 120; except comply with ASTM A 53 where close coiling or bending is required.

E. Electric-Resistance-Welded Steel Pipe: ASTM A 135.

F. Electric-Fusion-Welded Steel Pipe: ASTM A 671, A 672, or A 691.

G. Steel Water Pipe: AWWA C200 for pipe 6" (150 mm) and larger.

H. Coal Tar Protective Coatings and Linings for Steel Water Pipe: AWWA C203 for enamel and tape, hot applied.

I. Cast-Iron Flanged Fittings: ANSI B16.1, including bolting.

J. Cast-Iron Threaded Fittings: ANSI B16.4.

K. Malleable-Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.

L. Malleable-Iron Threaded Unions: ANSI B16.39; selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.

M. Threaded Pipe Plugs: ANSI B16.14.

N. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.

1. Material Group: Group 1.1.
2. End Connections: Buttwelding.
3. Facings: Raised-face.

O. Steel Pipe Flanges for Waterworks Service: AWWA C207.

P. Corrosion-Resistant Cast Flanges/Fittings: MSS SP-51, including bolting and gasketing.

Q. Forged-Steel Socket-Welding and Threaded Fittings: ANSI B16.11 except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.

R. Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns; rated to match connected pipe.

S. Cast-Iron Threaded Drainage Fittings: ANSI B16.12.

T. Forged Branch-Connection Fittings: Except as otherwise indicated, provide type as determined by Installer to comply with installation requirements.

U. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2" (40 mm), and where pipe size is less than 1-1/2" (40 mm), and do not thread nipples full length (no close-nipples).

2.3 COPPER TUBE AND FITTINGS

A. Copper Type: ASTM B 88; Type (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated.

B. DWV Copper Tube: ASTM B 306.

C. ACR Copper Tube: ASTM B 280.

D. Cast-Copper Solder-Joint Fittings: ANSI B16.18.

E. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.

F. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.4 CAST-IRON PRESSURE PIPES AND PIPE FITTINGS

A. Ductile-Iron Pipe: ANSI A21.51; AWWA C151.

B. Polyethylene Encasement for Gray and Ductile Cast-Iron Piping: ANSI A21.5; AWWA C105.

C. Cast-Iron Fittings: AWWA C110.

D. Gray-Iron Fittings: AWWA C110.

E. Ductile-Iron Fittings: AWWA C110.

F. Rubber-Gasket Joints: AWWA C111.

2.5 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

A. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.

1. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

B. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements.

1. Tin-Antimony Solder: ASTM B 32, Grade 95TA.
2. Silver Solder: ASTM B 32, Grade 96TS.

C. Brazing Materials: Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.

1. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.

D. Gaskets for Flanged Joints: ANSI B16.21; full-faced or cast-iron raised face for steel flanges, unless otherwise indicated.

E. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" (1.6 mm) misalignment tolerance.

1. Comply with ANSI B31 Code for Pressure Piping.

B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Where trapping is unavoidable, install drain valve with 3/4" (20 mm) hose end connection, cap and chain. Provide access panels as required. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent enclosure elements of building; limit clearance to 1/2" (13 mm) where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" (25 mm) clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

C. Exposed piping in finished areas shall be covered with a 16 gauge steel primed and painted metal cover, secured to an adjacent structure and painted to match adjacent surfaces.

D. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces.

3.2 PIPING SYSTEM JOINTS

A. General: Provide joints of type indicated in each piping system.

1. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
2. Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.
3. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

B. Weld pipe joints in accordance with ASME Code for Pressure Piping, B31.

C. Weld pipe joints in accordance with recognized industry practice and as follows:

1. Weld pipe joints only when ambient temperature is above 0°F (-18°C) where possible.
2. Bevel pipe ends at a 37.5˚ angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.

3. Use pipe clamps or tack-weld joints with 1" (25 mm) long welds; 4 welds for pipe sizes to 10" (250 mm), 8 welds for pipe sizes 12" (300 mm) to 20" (500 mm).
4. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.
5. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.

6. At Installer's option, install forged branch-connection fittings wherever branch pipe is indicated; or install regular "T" fitting.

D. Weld pipe joints of steel water pipe in accordance with AWWA C206.

E. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

3.3 PIPING INSTALLATION

A. All piping shall be installed level, plumb, and square relative to the adjacent building structure.

B. Group piping, where practical, and install from common supports.

3.4 CLEANING, FLUSHING, INSPECTING

A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

1. Inspect pressure piping in accordance with procedures of ASME B31.

B. Disinfect water mains and water service piping in accordance with AWWA C601.

3.5 PIPE TESTING

A. Refer to Division-23 section “Testing, Adjusting and Balancing” for pipe testing requirements.

END OF SECTION 23 05 14

SECTION 23 05 15

PIPING SPECIALTIES FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of piping specialties work required by this section is indicated on drawings and schedules and by requirements of this section.

B. Types of piping specialties specified in this section include the following:

1. Pipe Escutcheons
2. Pipeline Strainers
3. Dielectric Fittings
4. Mechanical Sleeve Seals
5. Penetration Seals
6. Drip Pans
7. Pipe Sleeves
8. Sleeve Seals
9. Flexible Connectors
10. Electric Pipe Trace

C. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-23 sections.

D. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. FCI Compliance: Test and rate "Y" type strainers in accordance with FCI 73-1 "Pressure Rating Standard for "Y" Type Strainers". Test and rate other type strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than "Y" Type".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.

B. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 PIPING SPECIALTIES

A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections.

2.2 PIPE ESCUTCHEONS

A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

2.3 LOW PRESSURE Y-TYPE PIPELINE STRAINERS

A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi (850 kPa) working pressure, with Type 304 stainless steel screens, with perforations as follows:

1. Piping 2" (50 mm) and Smaller: 1/32" (.8 mm) diameter perforations.
2. Piping 2-1/2" (65 mm) and Larger: 3/64" (1.2 mm) diameter perforations for water systems and 1/16" diameter perforations for steam systems.

B. Threaded Ends, 2" (50 mm) and Smaller: Brass body, screwed screen retainer with centered blowdown fitted with valve and pipe plug.

C. Threaded Ends, 2-1/2" (65 mm) and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.

D. Flanged Ends, 2-1/2" (65 mm) and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.

E. Butt Welded Ends, 2-1/2" (65 mm) and Larger: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.

F. Grooved Ends, 2-1/2" (65 mm) and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EDPM gasket.

2.4 DIELECTRIC FITTINGS

A. General: Provide assembly or fitting having insulating material to isolate dissimilar metals to prevent galvanic action and stop corrosion.

1. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035 kPa or 2070 kPa) minimum working pressure to suit system pressures.

2. Dielectric Nipples: Electroplated steel nipple, having inert and non-corrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig (2070 kPa) working pressure at 225°F (107°C) temperature.
3. Dielectric unions shall NOT be acceptable.

2.5 MECHANICAL SLEEVE SEALS

A. General: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 PENETRATION SEALS

A. Provide seals for all openings through fire-rated walls, floors, or ceilings used as passage for mechanical piping. See Division-23 Section “Basic HVAC Materials and Methods” for penetration seals and firestopping requirements.

B. Provide seals for all openings through walls, floors or ceilings used as passage for mechanical components such as piping.

2.7 FABRICATED PIPING SPECIALTIES

A. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2" (65 mm). Reinforce top, either by structural angles or by rolling top over 1/4" (6 mm) steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" (25 mm) drain line connection.

B. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" (75 mm) and smaller, 20 gage (1.0 mm); 4" to 6" (100 mm to 150 mm), 16 gage (1.6 mm); over 6" (150 mm), 14 gage (2 mm).
2. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.

2.8 FLEXIBLE CONNECTORS

A. Furnish and install braided stainless steel flexible connectors where indicated on drawings. Construction shall be of annular corrugated stainless steel close-pitch hose with stainless steel overbraid.

1. The corrugated metal hose, braids, and a stainless steel ring-ferrule/band (material gauge not less than .048") (material gauge not less than 1.2 mm) shall be integrally welded using a 100% circumferential, full-penetration TIG weld.
2. End fittings shall be flat-face plate steel flanges with 150#ANSI drilling and outside diameter. Fittings shall be attached using a 100% circumferential TIG/MIG weld.
3. Braided stainless steel connectors shall be suitable for operating temperatures up to 850˚F (454˚C).
4. The rated working pressure of braided metal hose shall have a minimum 4:1 safety factor based on an operating temperature of 70°F (20°C). Each braided stainless steel connector shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure.
5. Flanged connectors shall be prepared for shipment using cut-to-length spacers, securely positioned between the flanges to prevent axial compression damage and maintain the manufactured length. Spacers must be removed prior to system start-up.
6. All braided stainless steel connectors shall be covered by a three (3) year warranty.
7. Minimum overall lengths shall be as follows:

Through 4" (100 mm) diameter:	9" (225 mm)
5" (125 mm), 6" 150 mm) diameter:	11" (275 mm)
Over 6" (150 mm) diameter:	1.5 times nominal diameter

2.9 ELECTRIC PIPE TRACING

A. Furnish and install self-regulating pipe trace heater consisting of two (2) 16 AWG nickel plated copper bus parallel wires embedded in a self-regulating polymer core that varies its power output to respond to temperature along its length, allowing the heater to cross over itself without overheating, and to be cut to length in the field. The heater shall be covered by a radiation cross linked polyethylene dielectric jacket rated at 300 VAC at 222°F (105°C) with VW-1 flame resistance.

B. The heater shall operate on line voltage 120V, without the use of transformers.

C. The heater shall be sized according to the following table. The output rating is in watts per linear foot at 50°F (10°C).

Pipe Size	Heater Capacity
1/2 - 1 inch (13 mm - 25 mm)	3 W/LF (1 W/m)
1-1/4 - 2 inch (32 mm - 50 mm)	5 W/LF (1.6 W/m)
3 inch (75 mm)	5 W/LF (1.6 W/m)
4 inch (100 mm)	8 W/LF (2 W/m)

6 inch (150 mm)	8 W/LF (2 W/m)
8 inch (200 mm)	2 strips - 8 W/LF (2 W/m)
10 - 14 inch (250 mm - 350 mm)	2 strips - 8 W/LF (2 W/m)

D. All heating cable cores shall be permanently marked with manufacturer's batch or serial number for traceability. All cable jackets shall be continuously marked with manufacturer's name, catalog number, nominal supply voltage and nominal power output in watts per foot. Use of temporary printing or tags not permitted.

E. All cables shall be capable of withstanding 1,600 VAC RMS (50 to 60 HZ) applied for one minute between the parallel conductors and the metallic braid.

F. Power retention of the heating element shall be a minimum of 90% after a minimum of 30 thermal cycles between 50°F and 150°F (10°C and 66°C).

G. Power connection, end seal, splice and tee kit components shall be applied in the field.

H. The system shall be controlled by an ambient sensing thermostat set at 40°F.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration thru floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

B. Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2" (50 mm) and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to drain, full size of blow down connection.

1. Locate Y-type strainers ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment:

a. Pumps
b. Temperature control valves
c. Pressure reducing valves
d. Temperature or pressure regulating valves

C. Dielectric Fittings: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

D. Mechanical Sleeve Seals: Provide mechanical sleeve seals for sleeves located in foundation walls below grade, or in exterior walls. Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES

A. Drip Pans: Locate drip pans under piping passing over or within 3' (0.9 m) horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" (25 mm) drain line to drain connection, and run to nearest drain as indicated.

B. Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by the Owner. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than two (2) pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Sleeves through floors shall be flush with the floor, except for sleeves passing through equipment rooms, toilet rooms (and other wet areas) which shall extend 3/4" (20 mm) above the floor. Space between the pipe and sleeve shall be caulked. Escutcheons plates shall be constructed to conceal the ends of sleeves. Extend floor sleeves 1/4" (6 mm) above level floor finish and 3/4" (20 mm) above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

1. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings.
2. Install iron-pipe sleeves at exterior and interior foundation wall penetrations, both above and below grade. Penetrations shall be sealed weathertight.
3. Install steel-pipe except as otherwise indicated.

3.3 INSTALLATION OF ELECTRIC PIPE TRACING

A. Provide electric heat trace for all exterior piping, located above the local frost line, including, but not limited to exterior chilled water piping, etc.

B. Install the heater linearly on the pipe after piping has been successfully pressure tested. Secure the heater to piping with cable ties or type PF-1 polyester tape.

C. Apply "electric traced" signs to the outside of the thermal insulation.

D. Tests:

1. After installation and before and after installing the thermal insulation, subject heat to testing using a 1000 VDC megger. Minimum installation resistance should be 20 to 1000 megohms regardless of length.

3.4 INSTALLATION OF FLEXIBLE PIPE CONNECTORS

A. Provide flexible pipe connectors on the inlet and outlet of each pump, chiller, cooling tower and all other piping connected to a vibrating piece of equipment.

Flexible connectors shall be full line size as indicated on the drawings and should be provided with control rods.

END OF SECTION 23 05 15

SECTION 23 05 16

EXPANSION COMPENSATION FOR HVAC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of expansion compensation products required by this section is indicated on drawings and/or specified in other Division-23 sections.

B. Types of expansion compensation products specified in this section include the following:

1. Packless Expansion Joints:

a. Expansion Compensators

C. Expansion compensation products furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-23 sections.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. EJMA Compliance: Construct compensation products in accordance with standards of the Expansion Joint Manufacturer's Association (EJMA).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of expansion compensation product. Submit expansion compensation schedule showing manufacturer's figure number, size, location, and features for each required expansion compensation product.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of expansion compensation product, indicating dimensions, weights, required clearances, and methods of assembly of components.

C. Shop Drawings: Submit shop drawings for fabricated expansion loops indicating location, dimensions, pipe sizes, and location and method of attachment of anchors.

D. Maintenance Data: Submit maintenance data and spare parts lists for each type of expansion compensation product. Include this data, product data, and shop drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include the following:

1. Flexonics Inc., Metal Hose and Expansion Joint Div.
2. Keflex HVAC Products, Flex-Weld, Inc.
3. Metraflex Co.
4. Mason Industries, Inc.
5. Vibration Mountings and Controls, Subsidiary of ARX.

2.2 PACKLESS EXPANSION JOINTS

A. General: Provide packless expansion joints where indicated for piping systems, with materials and pressure/temperature ratings selected by installer to suit intended service. Select packless expansion joints to provide 200% absorption capacity of piping expansion between anchors.

B. Expansion Compensators: Pressure rated for 60 (415 kPa) psi for low pressure systems, 175 psi (1200 kPa) for high pressure systems; 2-ply phosphor bronze bellows, brass shrouds and end fittings for copper piping systems, or 2-ply stainless steel bellows, carbon steel shrouds and end fittings for steel piping systems. Provide internal guides and anti-torque device, and removable end clip for proper positioning.

2.3 MISCELLANEOUS MATERIALS

A. Pipe Alignment Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which expansion compensation products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 EXPANSION JOINTS

A. General: Install expansion joints where indicated, and elsewhere as required for adequate expansion of installed piping system. Install in accordance with manufacturer's instructions. Provide pipe anchors and pipe alignment guides as indicated, and in accordance with manufacturer's recommendations. Align units properly to avoid end loading and torsional stress.

3.3 EXPANSION LOOPS

A. General: Fabricate expansion loops as indicated, in locations indicated, and elsewhere as required for adequate expansion of installed piping system. Subject loop to cold spring which will absorb 50% of total expansion between hot and cold conditions. Provide pipe anchors and pipe alignment guides as required to properly anchor piping in relationship to expansion loops.

3.4 EXPANSION COMPENSATION FOR RISERS AND TERMINALS

A. General: Install connection between piping mains and risers with at least five (5) pipe fittings including tee in main. Install connections between piping risers and terminal units with at least four (4) pipe fittings including tee in riser.

3.5 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principle pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION 23 05 16

SECTION 23 05 19

METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of meters and gauges required by this section is indicated on drawings and/or specified in other Division-23 sections.

B. Types of meters and gauges specified in this section include the following:

1. Temperature Gauges and Fittings:

   a. Direct Mount Dial Thermometers
   b. Remote Reading Dial Thermometers
   c. Thermometer Wells

2. Pressure Gauges and Fittings:

   a. Pressure Gauges
   b. Pressure Gauge Cocks
   c. Pressure Gauge Connector Plugs
   d. Magnehelic Pressure Gauges

3. Flow Measuring Meters:

   a. Flow Meter Fittings
   b. Flow Measuring Readout Kit
   c. Permanently Mounted Flow Meters

C. Meters and gauges furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-23 sections.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.
2. ANSI and ISA Compliances: Comply with applicable portions of Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

B. Certification: Provide meters and gauges whose accuracies, under specified operating conditions, are certified by manufacturer.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of meter and gauge. Include scale range, ratings, and

calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

B. Maintenance Data: Submit maintenance data and spare parts lists for each type of meter and gauge. Include this data in Maintenance Manual.

PART 2 - PRODUCTS

2.1 DIRECT MOUNT DIAL THERMOMETERS

A. General: Provide direct mount dial thermometers of materials designed and constructed for use in service indicated.

B. Type: Vapor tension, universal angle.

C. Case: Drawn steel or brass, glass lens, 5" (125 mm) diameter. For gauges mounted above eight feet (2400 mm), 8" (200 mm) diameter gauge.

D. Adjustable Joint: Die cast aluminum, 180 degree adjustment in vertical plane, 360 degree adjustment in horizontal plane, with locking device.

E. Thermal Bulb: Copper with phosphor bronze bourdon pressure tube, one scale division accuracy.

F. Movement: Brass precision geared.

G. Scale: Progressive, satin faced, non-reflective aluminum, permanently etched markings.

H. Stem: Copper plated steel, or brass, for separable socket, length to suit installation.

I. Range: Conform to the following:

1. Hot Water: 30°F - 240°F (-1°C - 116°C).
2. Chilled Water: 30°F - 120°F (-1°C - 49°C).
3. Air: 40°F - 160°F (4°C - 71°C).

2.2 REMOTE READING DIAL THERMOMETERS

A. General: Provide remote reading dial thermometers of materials designed and constructed for use in service indicated.

B. Type: Vapor tension.

C. Case: Drawn steel or brass, glass lens, 5" (125 mm) diameter. For gauges mounted above eight feet (2400 mm), 8" (200 mm) diameter shall be used.

D. Movement: Brass, precision geared.

E. Tubing: Bronze double braided armor over copper capillary, length to suit installation.

F. Bulb: Copper with separable socket for liquids, averaging element for air.

G. Accuracy: ± one scale division.

H. Range: Conform to the following:

1. Hot Water: 30°F - 240°F (-1°C - 116°C).
2. Chilled Water: 30°F - 120°F (-1°C - 49°C).
3. Air: 40°F - 160°F (4°C - 71°C).

2.3 THERMOMETER WELLS

A. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" (50 mm) extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

B. Manufacturer: Same as thermometers.

2.4 PRESSURE GAUGES

A. General: Provide pressure gauges of materials designed and constructed for use in service indicated.

B. Type: General use, 1% accuracy, ANSI B 40.1 Grade A, phosphor bronze bourdon type, bottom connection.

C. Case: Drawn steel or brass, glass lens, 5" (125 mm) diameter. For gauges mounted above eight feet (2400 mm), 8" (200 mm) gauges shall be used.

D. Connector: Brass with 1/4" (6 mm) male NPT.

E. Scale: White coated aluminum, with permanently etched markings.

F. Range: Conform to the following:

1. Vacuum: 30" Hg (102 kPa) - 15 psi (103 kPa).
2. Water: 0 - 100 psi (0 - 690 kPa).

2.5 PRESSURE GAUGE COCKS

A. General: Provide pressure gauge cocks between pressure gauges and gauge tees on piping systems. Construct gauge cock of brass with 1/4" (6 mm) female NPT on each end, and "T" handle brass plug.

B. Syphon: 1/4" (6 mm) straight coil constructed of brass tubing with 1/4" (6 mm) male NPT on each end.

C. Snubber: 1/4" (6 mm) brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

D. Manufacturer: Same as for pressure gauges.

2.6 PRESSURE GAUGE CONNECTOR PLUGS

A. General: Provide pressure gauge connector plugs pressure rated for 500 psi (3448 kPa) and 200˚F (93˚C). Construct of brass and finish in nickel plate, equip with 1/2" (13 mm) NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" (3 mm) O.D. probe assembly from dial type insertion pressure gauge. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

2.7 MAGNEHELIC PRESSURE GAUGES

A. Provide direct reading magnehelic gauges indicating pressure drop across each filter assembly. The inlet and outlet of filter assembly shall be provided with remote dial type gauges of suitable ranges.

2.8 FLOW METER FITTINGS

A. Furnish and install venturi flow metering elements at each balancing valve location indicated on plans and drawings. Elements 2" (50 mm) and smaller shall be constructed of brass with threaded connections, 2-1/2" (65 mm) and larger shall be constructed of steel with butt weld or flanged connections.

B. Each primary element shall be selected to permit the design flow rate to fall between 20% to 80% of the full range on the linear scale of the meter. The permanent pressure loss shall not exceed 10% of the indicated flow rate differential.

C. The accuracy shall be ±3% of flow rate in the flow range indicated on the tabulation as verified by a recognized Independent Laboratory specializing in the research, testing and application of fluid meters, valves and hydraulics.

D. Each element shall be complete with instrument shut-off valves each with quick disconnect connections and identification tag with a chain, pressure rated to 300 psi (2069 kPa), temperature rated to 250°F (121°C).

E. Flow meter fittings shall be as manufactured by Preso, Flow Design or Flowset.

2.9 FLOW MEASURING READOUT KIT

A. Provide portable flow meters with bellows type differential pressure element and minimum 5" (125 mm) diameter indicating dial.

B. Design pressure elements for full scale pressure differential of 50" or 100" water gauge (12.4 kPa or 24.9 kPa). Design shall incorporate rupture-proof metal beryllium or stainless steel bellows and torque tube drive requiring no lubrication. Design forged bodies for not less than 150% of maximum surge pressure, fully protected against surges, with full provision for venting and draining. Provide integral, adjustable pulsation dampers.

C. Dials of portable meters shall have square root scales not less than 12" (300 mm) in developed length. Dials shall read from 0 to 10 gpm (0 to .6 L/s) to which multiplier is to be applied, as required; also provide with uniform scale reading from 0" to 10" w.g. (0 kPa to 2.5 kPa), to which multiplier of 10 is to be applied

(100" at full scale) (2.5 m at full scale), or from 0" to 5" w.g. (0 kPa to 1.2 kPa), to which multiplier of 10 is to be applied (50" at full scale) (2.5 m at full scale).

D. Engineer and manufacture in accordance with ASME recommendations for flow meters. Provide portable meters with overall accuracy of ± 5%.

E. Provide flow meter with factory-fabricated carrying case with integral carrying handle. Case shall be fitted to hold meter and following accessories:

1. Two 10' (3 m) lengths of connecting hose with suitable female connectors for connecting to venturi tube pressure tap nipples. Design hose for operating pressure of minimum of 150% of maximum system operating pressure.
2. Completely assembled 3-valve manifold with 2 block valves and vent and drain valves shall be piped and mounted on base, which shall be designed for use laying flat on stationary base.
3. Bound set of descriptive bulletins, installation and operating instructions, parts list, and set of curves showing flow verses pressure differential for each orifice or venturi tube with which meter is to be used.
4. Metal instruction plate, secured inside cover, illustrating use of meter. Deliver meter with case to Owner.

2.10 PERMANENTLY MOUNTED FLOW METERS

A. Provide permanently mounted meters consisting of bellows type differential pressure element and either indicating or recording and integrating element as noted in schedule or indicated on drawings.

B. Differential pressure elements and indicating or recording and integrating elements generally shall be direct-connected, but pneumatic electric or electronic transmission elements shall be used when particular installation precludes use of direct-connected units. Pneumatic, electric or electronic transmission elements shall be provided wherever pressure-sensing lines required for, direct transmission would exceed 150' (45 m) in length or cannot be graded properly. Connect each flow meter to primary element as specified and provide with all piping, wiring, and accessories required for complete installation. Provide flow metering equipment supplied by single manufacturer or coordinated by single supplier.

C. Permanently mounted meter installations (primary flow measuring element and flow meter) shall have overall accuracy of +2% of full scale flow over range of 20% to 100%of full scale flow. Engineer and manufacture primary elements of meters in accordance with ASME recommendations for flow meters.

D. Design bellows type differential pressure elements (meter bodies) for full scale pressure differential of 50" w.g. to 100" w.g. (12.5 kPa to 25 kPa). Design shall incorporate rupture-proof stainless steel or copper metal bellows and torque tube drive requiring no lubrication. Design forged meter bodies for not less than 150% of maximum system pressure and fully protect against surges, with provision for venting and draining. Provide meter bodies with integral, adjustable pulsation dampers.

E. Provide meter with complete copper tubing connections of approved sizes between differential pressure elements (meter bodies) and venturi tubes. Include necessary vent and drain valves as recommended by meter manufacturer.

F. Dials shall be flush type reading directly in gallons per minute.

G. Enclose recordings and integrating elements of each recording and integrating meter in dust-tight case. Arrange case for flush panel mount. Elements shall record flow continuously on 7 day, 12" (300 mm) diameter, linear chart. Integrators shall be of 7 figure direct reading type with either 15-second or continuous operating cycle. Furnish one-year supply of charts, pens and ink for each meter and deliver to Owner.

H. Design remote transmitters and receivers so that normal changes in air supply system pressure or in electric power supply system voltage or frequency will not affect accuracy of meters. Measuring circuits shall be relieved of all work required to move mechanical parts.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which meters and gauges are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TEMPERATURE GAUGES

A. General: Install temperature gauges in vertical upright position, and tilted so as to be easily read by observer standing on floor.

B. Locations: Install direct mounted thermometers in the following locations, and elsewhere as indicated:

1. At inlet and outlet of each hydronic zone.
2. At inlet and outlet of each hydronic boiler and chiller.
3. At inlet and outlet of each hydronic coil in air handling units.
4. At inlet and outlet of each hydronic heat exchanger.
5. At inlet and outlet of each hydronic heat recovery unit.
6. At suction and discharge of each hydronic pump.
7. Supply, return, fresh air and mixed air for each air handling unit.

C. Remote Reading Dial Thermometers: Install on control panels as indicated. Run tubing between panel and thermometer bulb, adequately supported to prevent kinks. Select tubing length so as to not require coiling of tubing.

D. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical upright position. Fill well with oil or graphite, secure cap.

3.3 INSTALLATION OF PRESSURE GAUGES

A. General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position.

B. Locations: Install in the following locations, and elsewhere as indicated:

1. At suction and discharge of each pump.

2. At inlet and outlet of each pressure reducing valve.
3. At incoming services (gas).
4. At chilled water inlets and outlets of chillers.
5. At inlet and outlet of large strainers.
6. At inlet and outlet of hydronic heat exchangers.
7. At steam inlet to heat exchangers, water heaters, etc.
8. At inlet of expansion tanks.
9. At inlet and outlet of water filtration systems.
10. At inlet and outlet of each coil.

C. Pressure Gauge Cocks: Install in piping tee with snubber.

D. Pressure Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.4 INSTALLATION OF PERMANENTLY MOUNTED FLOW METERS

A. General: Install flow measuring meters on piping systems as indicated.

3.5 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked or broken windows and repair any scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION 23 05 19

SECTION 23 05 23

VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of valves required by this section is indicated on drawings and/or specified in other Division-23 sections.

B. Types of valves specified in this section include the following:

1. Gate Valves
2. Globe Valves
3. Drain Valves
4. Ball Valves
5. Butterfly Valves
6. Check Valves

C. System Descriptions:

1. HVAC Piping: HVAC piping shall relate to chilled water, heating water, condenser water and glycol systems.

D. Valves furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division-23 sections.

1.2 QUALITY ASSURANCE

A. Valve Types: Provide valves of same type by same manufacturer.

B. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating and size clearly marked on valve body.

C. Codes and Standards:

1. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".
2. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing manufacturer's figure number, size, location, and valve features for each required valve.

B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of valve. Include this data, product data, and shop drawings in Maintenance Manual.

PART 2 - PRODUCTS

2.1 VALVES - GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following, unless otherwise noted:

1. Milwaukee
2. Bray
3. Apollo
4. DeZurik
5. Jamesbury
6. Watts

B. Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide end connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

C. Size: Unless otherwise indicated, provide valves of same size as upstream pipe size. Pipe size reduction shall be made after valve assembly.

D. Valve Features: Provide the following as required:

1. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ASME B31.9 for building services piping, and ASME B31.1 for power piping.
2. Bypass: Comply with MSS SP-45, and except as otherwise indicated, provide manufacturer's standard bypass piping and valving.
3. Drain: Comply with MSS SP-45, and provide threaded pipe plugs.
4. Flanged: Valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5, (steel), or ANSI B16.24 (bronze).
5. Threaded: Valve ends complying with ANSI B2.1.
6. Butt-Welding: Valve ends complying with ANSI B16.25.
7. Socket-Welding: Valve ends complying with ANSI B16.11.
8. Solder-Joint: Valve ends complying with ANSI B16.18.
9. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

10. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6" (150 mm) and smaller. Provide gear operators for quarter-turn valves 8" (200 mm) and larger. Provide chain-operated sheaves and chains for overhead valves as indicated.

2.2 GATE VALVES

A. Comply with the following standards:

1. Cast-Iron Valves: MSS SP-70.
2. Bronze Valves: MSS SP-80.
3. Steel Valves: ANSI B16.34.

2.3 GLOBE VALVES

A. Comply with the following standards:

1. Cast-Iron Valves: MSS SP-85.
2. Bronze Valves: MSS SP-80.
3. Steel Valves: ANSI B16.34.

B. HVAC Piping:

1. 2" (50 mm) and Smaller: Class 150, bronze body, union bonnet, integral seat, renewable TFE disc. Milwaukee Model 590T (Threaded), 1590T (Sweat) or equivalent.
2. Flanged Ends; 2-1/2" (65 mm) and Larger: Class 125, iron body, bolted bonnet, renewable seat and disc, bronze mounted. Milwaukee Model F2981A or equivalent.

2.4 DRAIN VALVES

A. HVAC Piping:

1. 3” (75 mm) and Smaller: Class 125, bronze body ball valve with chrome plated ball, hose end with cap and chain. Milwaukee BA100H (Threaded), Milwaukee BA150H (Sweat) or equivalent.

2.5 BALL VALVES

A. Comply with the following standards:

1. Bronze Valves: MSS SP-110.
2. Potable Water: NSF-61-8.

B. HVAC Piping:

1. 2” (50 mm) and Smaller: Valves shall be rated 150 psi (1035 kPa) SWP and 600 psi (4140 kPa) non-shock WOG and shall have 2-piece cast ASTM B 584 bronze bodies, TFE seats, standard port, separate packing nut with adjustable stem packing, anti-blowout stems and stainless steel

ball. Valve ends shall have full depth ANSI threads or extended solder connections and be manufactured to comply with MSS-SP110. Milwaukee BA100S (Threaded), BA150S (Sweat) or equivalent with NSF compliance for potable water.

C. Where piping is insulated, ball valves shall be equipped with 2" (50 mm) extended handles of non-thermal conductive material. Also, provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Memory stops, which are fully adjustable after insulation is applied, shall be included.

2.6 BUTTERFLY VALVES

A. General: Comply with MSS SP-67. Where butterfly valves are used as shutoffs for terminal or equipment removal or repair, select bubble tight, lug body type valves suitable for dead end service.

B. HVAC Piping:

1. 2-1/2 " (65 mm) to 6" (150 mm): 150 psi (1035 kPa), carbon steel or 316 stainless steel body, extended neck, 316 stainless steel disc, single piece RPTFE seat with stainless steel spring insert, self-lubricating bearings, double shaft and manual lever and lock. Milwaukee Model HP1LCS4212 or equivalent.
2. 8" (200 mm) and Larger: 150 psi (1035 kPa), carbon steel or 316 stainless steel body, extended neck, 316 stainless steel disc, single piece RPTFE seat, self-lubricating bearings, double offset shaft, manual lever and lock and gear operator. Milwaukee Model HP1LCS4213 or equivalent.
3. All valves shall be capable of bubble tight dead end service in either direction without use of additional pinning, screws or mating flanges.
4. Valves shall have pressure energized type seats of RPTFE with seat energizing insert. EPDM rubber seats are not acceptable. Seats shall be field replaceable.
5. Provide packing gland with "V" type ring packing, externally adjustable. Packing gland, nuts and studs shall be constructed of stainless steel.

2.7 CHECK VALVES

A. Comply with the following standards:

1. Cast-Iron Valves: MSS SP-71.
2. Bronze Valves: MSS SP-80.
3. Steel Valves: ANSI B16.34.

B. HVAC Piping:

1. 2" (50 mm) and Smaller: Class 150, bronze body, horizontal swing, T pattern with renewable TFE disc. Milwaukee 510T (Threaded), 1510T (Sweat) or equivalent.
2. 2-1/2" (65 mm) and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends. Milwaukee F2974A or equivalent.

2.8 BALANCE VALVES

A. HVAC: See Division-15 section “Hydronic Specialties” for HVAC balance valve specification, however all valves shall meet the requirements of this Section.

B. Plumbing: For potable water applications, valves shall be “lead-free” in accordance with local, state and federal codes, as well as, NSF/ANSI 372 (NSF 61-G). Balance valves for hot water recirculating systems shall be venturi type with an accuracy of 3% at full scale; RWV or equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Except as otherwise indicated, comply with the following requirements.

1. Install valves where required for proper operation of piping and equipment, including valves in branch lines, service mains and all equipment connections. Locate valves so as to be accessible and so that separate support can be provided when necessary.
2. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

B. Insulation: Where insulated, install extended-stem valves, arranged in proper manner to receive insulation.

C. Mechanical Actuators: Install mechanical actuators with chain operators where indicated. Extend chains to approximately five feet (1500 mm) above floor and secure to clips to clear aisle passage.

D. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with connections to match pipe fittings.

E. Renewable Seats: Install valves with renewable seats, where applicable.

F. Fluid Control: Except as otherwise indicated, install gate, ball, globe, and butterfly valves to comply with ANSI B31.9. Where throttling is indicated or recognized as principle reason for valve, install ball, globe or butterfly valves, as indicated.

G. Installation of Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.

3.2 ADJUSTING AND CLEANING

A. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.

B. Valve Identification: Tag each valve in accordance with Division-23 section "Identification for HVAC Piping and Equipment".

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 23 05 23

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of hangers and supports required by this section is indicated on drawings and/or specified in other Division-23 sections.

B. Types of hangers and supports specified in this section include the following:

1. Horizontal-Piping Hangers and Supports
2. Vertical-Piping Clamps
3. Hanger-Rod Attachments
4. Building Attachments
5. Saddles and Shields
6. Spring Hangers and Supports
7. Miscellaneous Materials
8. Roof Equipment Supports
9. Anchors
10. Equipment Supports

C. Hangers and supports furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-23 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of hangers and supports, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. Code Compliance: Comply with applicable codes pertaining to product materials and installation of hangers and supports.
2. NFPA, UL, and FM Compliance: Provide products which comply with NFPA 13 listed and labeled by UL and FM where used for fire protection piping systems.
3. MSS Standard Compliance:

a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
b. Select and apply pipe hangers and supports, complying with MSS SP-69.
c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
d. Terminology used in this section is defined in MSS SP-90.

PART 2 - PRODUCTS

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, selected by Installer to suit horizontal-piping systems in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.2 VERTICAL-PIPING CLAMPS

A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SP-58, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.3 HANGER-ROD ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.4 BUILDING ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.5 SADDLES AND SHIELDS

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

2.6 SPRING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated spring hangers and supports complying with MSS SP-58, selected by Installer to suit piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select spring hangers and supports to suit pipe size and loading.

2.7 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2).

D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which hangers and supports are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BUILDING ATTACHMENTS

A. Install attachments at required locations within concrete or steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi (17240 kPa) is indicated, install reinforcing bars through openings at top of inserts.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Support fire-water piping independently of other piping.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

E. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

F. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

H. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on chilled water piping, install coated protective shields.

3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.
4. For all insulated piping 2-1/2” (63 mm) and larger, provide insulated saddles as follows:

a. For chilled water, as well as heating water, provide the following:

1) Minimum 3.5 pcf, non-compressive, rigid, phenolic foam insulation. Fire and smoke rating shall be 25/50 or below per ASTM 84.
2) For cold applications below 75ºF (24ºC) a zero permeability abuse resistant vapor barrier shall be provided with matching butt strips. Apply a full coating of butyl joint sealant in addition to the butt strips for a completely sealed system.
3) The phenolic foam system shall have a K factor of 0.16 at a mean temperature for 75ºF (24ºC) and comply with ASTM Standard C1126.
4) Provide visible inspection sticker at the bottom of each saddle.
5) Pipe insulation saddles shall be Tru-Balance CoolDry Saddles as manufactured by Buckaroos, Inc. or equivalent.

I. Spacing: Hanger spacing for piping shall not exceed 8 feet (2400 mm) on centers for pipe 1-1/4" (32 mm) or smaller, and 10 feet (3 m) for pipe 1-1/2" (40 mm) and larger. Regardless of spacing, hangers shall be provided at or near all changes in direction, both vertical and horizontal, for all piping. For cast iron soil pipe, one hanger shall be placed at each hub or bell.

3.4 ADJUSTMENT OF HANGERS AND SUPPORTS

A. Adjust hangers and supports and place grout as required under supports to bring piping to proper levels and elevations.

3.5 EQUIPMENT SUPPORTS

A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division-23. Size bases to extend minimum of 4" (100 mm) beyond equipment base in any direction; and 4" (100 mm) above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

3.6 PAINTING

A. All hangers, supports, clamps and assemblies shall be primed and painted with rust inhibitors.

END OF SECTION 23 05 29

SECTION 23 05 48

VIBRATION ISOLATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: The extent of vibration isolation work to be provided under this Contract is covered by the requirements of this Section, all other Division-23 sections and the Contract Drawings including structural, architectural, mechanical and electrical which identify equipment and systems requiring vibration isolation treatment.

B. Types: Types of vibration isolation equipment and systems specified in this Section include:

TYPE	DESCRIPTION
1 Isolator	Ribbed Neoprene Pads
2I Isolator	Neoprene-In-Shear Type
2H Hanger	Rubber-In-Shear Type
3I Isolator	Open Spring Type
3H Hanger	Combination Spring and Neoprene Type
4 Isolator	Vertically Restrained Spring Isolators
5 Thrust	Restraints Spring Type Installed in Pairs
A Base	Directly Bolted Attachment
B Base	Structural Rails or Bases
C Base	Concrete Inertia Type

C. Selection of Isolators: Provide isolators selected by a vibration isolator equipment specialist.

1. Conform to isolator types herein specified.
2. Examine the contract drawings for sizes, horsepowers, rotational speeds, equipment location, length of span between columns and beams and construction type to determine the isolator selection type and deflection required for each piece of mechanical equipment.
3. Conform to the requirements of the most current edition of American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Handbook, "HVAC Applications", Sound and Vibration Control.

1.2 QUALITY ASSURANCE

A. Codes: At a minimum, conform to the most current edition of ASHRAE Handbook, "HVAC Applications".

B. Manufacturer: Isolators of the same type shall be the product of the same manufacturer. The manufacturer shall publish and maintain a full line of materials, engineering and application data and operating and maintenance instructions.

1.3 SUBMITTALS

A. Contractor's Certification: Vibration isolator submittals shall include a certification, signed by an officer representing the Contractor and stipulating that the submittal prepared by the manufacturer has been reviewed, and checked on an item by item basis against each piece of mechanical equipment, shown or specified in the Contract Documents, which requires vibration isolation.

B. Manufacturer's Certification: The manufacturer or manufacturers (if there are more than one) shall each certify that the selections of vibration isolation equipment are based upon the drawings and specifications, and that each piece of mechanical equipment has been examined for rotational speed, equipment type, mounting location, and supporting span between column centers, and that an appropriate isolator has been selected.

C. Product Data: Furnish manufacturer's product data covering each isolator type for style, characteristic, and finish.

1. Isolator quantities, dimensions, deflections, capacities and types shall remain the responsibility of the manufacturer and the Contractor.

D. Shop Drawings: Where coordinated shop drawings are required, provide layout drawings, drawn to a scale of not less than 1/4-inch to 1-foot (6 mm to 300 mm), showing the proposed layout of equipment and piping systems and the location and type of each vibration isolation device.

1. Carefully examine other sections requiring coordinated shop drawings and prepare isolation shop drawings to the same scale showing the location of each vibration isolation equipment base, pipe hanger, flexible connection, and isolator.

1.4 STORAGE AND PROTECTION

A. Storage: Store vibration isolation equipment indoors in the manufacturer's original shipping containers. Preclude the entrance of construction dirt and debris.

1. Vibration isolation equipment and bases, which show signs of rust, cement or concrete fouling, dirt and construction debris shall be disassembled and cleaned, approved or removed from the project site and replaced with new.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Mason
2. Vibration Eliminator Co.
3. Kinetics Noise Control

2.2 EQUIPMENT

A. Dimensions: The schedule shows dimensions for deflection and sizes all in inches.

B. Spans: Where referenced, the schedule shows spans of the longest bay dimension for slabs or beams supported between columns. Dimensions are in feet.

C. Selection: Exact mounting sizes, dimensions and quantity of isolators and static deflection required shall be determined by the isolator manufacturer based upon equipment that will be furnished and installed by the Contractor under this Contract.

1. Vibration isolation specialist shall coordinate his work with that of other trades to verify that equipment speeds, in revolutions per minute (rpm), are based upon actual equipment installed at the project site.
2. Verify that equipment rpm and spring deflection selected are arranged so that resonance is avoided.

2.3 ISOLATOR TYPES

A. Type 1 Isolators: Provide pad type vibration isolators consisting of either two layers of 3/8-inch (10 mm) thick elastomer, molded to contain a pattern with non-slip characteristics in all directions, and bonded to 16 gauge (1.6 mm) galvanized steel separator plates, or 1-inch (25 mm) thick precompressed molded fiberglass isolation pads. Minimum overall thickness shall be 1-inch (25 mm). Deflection shall be limited to 0.25 inches (6 mm) or less. Loading shall not exceed 40 pounds per square inch (280 kPa).

B. Type 2I Isolators: Provide double rubber-in-shear or elastomer-in-shear with molded-in steel reinforcement in the top and bottom portions.

1. Deflections shall be limited to 0.5 inches (13 mm) or less.
2. Steel bases shall be drilled with mounting holes and equipment mounting points shall be threaded male or female connections.
3. Treat resilient material with antiozone and antioxidant additives.

C. Type 2H Hangers: Provide rubber-in-compression suspension hangers, consisting of a formed steel frame and elastomer isolation element and provided with attachments for top and bottom suspension rods.

1. Design for a minimum 200 percent overload without noticeable deformation or failure.
2. Metal components shall be galvanized or factory painted.

D. Type 3I Isolators: Provide adjustable, freestanding, open spring isolators with combination leveling and equipment fastening bases.

1. Spring elements shall be contained in upper and lower housing assemblies and shall have a minimum Kx-Ky of 0.75.
2. Design springs for a minimum travel of 50 percent beyond the rated load.
3. When fully compressed and "bottomed-out", isolators shall be capable of supporting a 150 percent overload without deformation and spring failure.

4. A minimum 1/4-inch (6 mm) thick non-skid isolation pad shall be bonded to the underside of the base plate.
5. Size base plates to limit floor loading to 100 pounds per square inch (690 kPa).
6. Drill base plates for bolting, as required.
7. Provide means for anchoring the top element of the isolator to rails and equipment.

E. Type 3H Hangers: Provide combination spring and elastomer hangers consisting of a formed steel frame with coil spring and elastomer insert in compression.

1. Design hangers to be capable of supporting a 200 percent overload without noticeable deformation or failure.
2. Design hangers to allow a 30 degree misalignment without binding or a reduction in hanger efficiency.
3. Design hangers for connection to equipment and supporting rods.

F. Type 4 Isolators: Provide vertically restrained, freestanding, laterally stable, open spring type isolators.

1. Design for deflection exceeding 1/2-inch (13 mm).
2. Provide built-in bearing and leveling provisions.
3. Provide a minimum 1/4-inch (6 mm) thick non-slip elastomer vibration absorbing pad bonded to the underside of the isolator base.
4. Outside diameter of each spring shall be equal to or greater than 0.9 times the operating height of the spring under rated load.
5. Provide vertical limit stops to prevent hyperextension due to wind loads or upward movement when the load is removed. Limit stops shall not bind or inhibit spring movement during normal operating ranges.
6. For exterior applications, steel housings shall be hot dipped galvanized and springs shall be neoprene or powder coated.

G. Type 5 Thrust Restraints: Provide spring isolators of an adjustable, freestanding type enclosed within tubular mountings and arranged to be installed in pairs across the discharge of fan flexible connectors.

1. Design restraints to resist the thrust caused by duct internal air pressure.
2. Install restraints on duct systems with an internal static pressure exceeding 3 inches water gauge (750 Pa).
3. Restraints shall have the same deflection as isolators installed under the fans.

2.4 BASE TYPES

A. Type A Bases: No supplementary base is required. Vibration isolators, specified elsewhere, shall be attached directly to the supported equipment or structural system.

B. Type B, Structural Rails or Bases: Provide bases designed and supplied by the isolation equipment manufacturer.

1. Construct bases of mill rolled structural sections of sufficient dimension to limit the midpoint deflection or unsupported spans to 1/1440th of the span between isolators.

2. Include equipment static loadings, power transmission, component misalignment and cantilever loadings when designing structural sections.
3. When head room is limited, coordinate the design of structural rails and isolators to reduce mounting heights.
4. Factory finish with two (2) coats of equipment enamel.

C. Type C, Concrete Inertia Bases: Provide concrete inertia bases designed by the isolator manufacturer and arranged to be filled with concrete in the field.

1. Construct base of mill rolled structural steel sections, factory mitered and welded into a rigid frame and supporting No. 4 reinforcing bars welded to the structural frame 8 inches (200 mm) on centers both ways and located 2 inches (50 mm) from the bottom of the block.
2. Arrange for outrigger isolation mountings, anchor bolts and equipment support.
3. Field fill with 3,000 psi cured-strength concrete. Trowel to a smooth hard finish.
4. Clean structural steel of excess concrete and field paint all steel elements with two coats equipment enamel.
5. Configuration of inertia bases shall be rectangular to accommodate equipment supported unless otherwise indicated.
6. Minimum thickness of inertia bases, in addition to providing suitable mass, shall be sufficient to provide stiffness to maintain equipment manufacturer's recommended alignment and duty efficiency of power transmission.
7. Minimum thickness shall be sufficient to result in a base deflection at midpoint of unsupported span of not more than 1/1440th of the span between isolators.
8. Minimum thickness shall be 8 percent of the longest base dimension unless otherwise specified or indicated.
9. For centrifugal pumps, the bases shall be a minimum 6 inches (150 mm) thick.
10. Where inertia bases are used to mount pumps, the bases shall be long enough to support piping elbows for all connections.

2.5 PIPING AND DUCTWORK

A. General: All ductwork and piping in mechanical equipment rooms and within fifty feet (15 m) of the vibration source (i.e. mechanical equipment such as air handling units, chillers, pumps, air compressors, etc.) shall be isolated from the building structure with flexible vibration isolators. Air handling units with less than two inches (500 Pa) of external static pressure shall be excluded from this requirement.

1. Suspend ductwork on Type 3H hangers.
2. Suspend piping on Type 3H hangers.
3. Floor-mounted ductwork and piping shall be supported with Type 4 spring isolators with deflections the same as the equipment to which the piping is attached.

B. Reciprocating Equipment: Provide spring type hangers with deflections equal to that of reciprocating equipment, with piping arranged with offset elbows to absorb vibration.

C. Risers: Pipe and duct risers within 100 feet (30 m) of mechanical equipment rooms shall be resiliently anchored to the building structure with Type 1 vibration isolators, near the midpoint of the risers.

1. Risers shall be isolated and supported at each second floor with pairs of Type 3H hangers, having deflections a minimum of five times the anticipated thermal movement at the support point.
2. Risers shall be guided as required with four (4) sets of Type 2I vibration isolators.
3. Provide flexible neoprene or canvas connectors as specified in sheet metal ductwork at the connection point to all air moving equipment.
4. Support ductwork with an internal pressure exceeding 3 inches (750 Pa) water with Type 3H hangers on maximum 10 foot (3 m) centers with deflections equal to the equipment isolators.

2.6 VIBRATION ISOLATION SYSTEM SELECTION

A. General: The following selections of vibration isolation equipment systems shall be considered as a minimum. For the equipment below, the following code applies:

Letter (i.e. A, B, C) = Base type
Number (i.e. 1, 2, 3, 4) = Isolator type
Decimal number (i.e. 0.25, 1.5, etc.) = Minimum deflection

B. Outdoor Air Cooled Rotary Screw or Scroll Chillers

SLAB ON GRADE	20 FOOT (6M) ROOF SPAN	30 FOOT (9 M) ROOF SPAN	40 FOOT (12 M) ROOF SPAN
A 2 0.50	A 2 0.50	A 2 0.50	A 2 0.50

C. Refrigeration Reciprocating Compressors

BASEMENT BELOW GRADE	20 FOOT (6 M) FLOOR SPAN	30 FOOT (9 M) FLOOR SPAN	40 FOOT (12 M) FLOOR SPAN
C 3 0.75	C 3 0.75	C 3 1.5	C 3 2.0

D. Air Compressors

TYPE EQUIPMENT	BASEMENT BELOW GRADE	20 FOOT (6M) FLOOR SPAN	30 FOOT (9 M) FLOOR SPAN	40 FOOT (12 M) FLOOR SPAN
Tank Mounted	A 3 0.75	A 3 0.75	A 3 1.5	A 3 2.5
Base Mounted To 500 rpm (52 Rad/s)	C 3 0.75	C 3 0.75	C 3 0.75	C 3 1.5
Over 500 rpm (Over 52 Rad/s)	C 3 0.75	C 3 0.75	C 3 1.5	C 3 1.5

E. Centrifugal Pumps

TYPE EQUIPMENT	BASEMENT BELOW GRADE	20 FOOT (6M) FLOOR SPAN	30 FOOT (9 M) FLOOR SPAN	40 FOOT (12 M) FLOOR SPAN
Close-coupled thru 7-1/2 hp (5.6 kW)	B or C 2 0.25	C 3 0.75	C 3 0.75	C 3 0.75
Close-coupled 10 hp & above (7.4 kW & above)	C 3 0.75	C 3 0.75	C 3 1.5	C 3 1.5
Bedplate-mounted thru 40 hp (30 kW)	C 3 0.75	C 3 0.75	C 3 1.5	C 3 1.5
50 to 125 hp (37 to 95 kW)	C 3 0.75	C 3 0.75	C 3 1.5	C 3 1.5

F. Air-Cooled Condensing Units

20 FOOT (6 M) ROOF SPAN	30 FOOT (9 M) ROOF SPAN	40 FOOT (12 M) ROOF SPAN
A 2 0.25	A 2 0.35	A 2 0.5

G. Low-Pressure AHU Locations (To 3-Inch W.G.) (750 Pa)

TYPE EQUIPMENT	BASEMENT BELOW GRADE	20 FOOT (6M) FLOOR SPAN	30 FOOT (9 M) FLOOR SPAN	40 FOOT (12 M) FLOOR SPAN
Thru 10 hp (7.5 kW)	A 2 0.25	A 3 0.75	A 3 1.0	A 3 1.0
TYPE EQUIPMENT	BASEMENT BELOW GRADE	20 FOOT (6M) FLOOR SPAN	30 FOOT (9 M) FLOOR SPAN	40 FOOT (12 M) FLOOR SPAN
15 hp & over (11 kW & over) 250 to 500 rpm (26 to 52 Rad/s)	A 2 0.35	A 2 1.5	A 3 1.75	A 3 1.75
500 rpm (52 Rad/s)	A 2 0.35	A 3 1.0	A 3 1.5	A 3 1.75

Note: Where floor mounted air handling units are provided with internal vibration isolation for all vibration producing components, provide ¾" neoprene pads.

H. Medium and High-Pressure AHU Locations (3-inch W.G. and above) (750 Pa and above)

TYPE EQUIPMENT	BASEMENT BELOW GRADE	20 FOOT (6M) FLOOR SPAN	30 FOOT (9 M) FLOOR SPAN	40 FOOT (12 M) FLOOR SPAN
Thru 20 hp (Thru 15 kW) 300 to 500 rpm (Up to 52 Rad/s)	A 3 0.35	A 3 1.0	A 3 2.0	A 3 2.5
Over 20 hp (Over 15kW) 500 rpm and over (52 Rad/s and over)	A 3 1.0	A 3 1.5	A 3 1.5	A 3 2.5

Note: Where floor mounted air handling units are provided with internal vibration isolation for all vibration producing components, provide 3/4" neoprene pads.

I. Air Moving Device Locations

Vibration isolation provisions apply to housed or unhoused freestanding fans of any pressure rating, located in field-erected central-station units or in unhoused return air or supply air service.

TYPE EQUIPMENT	BASEMENT BELOW GRADE	20 FOOT (6M) FLOOR SPAN	30 FOOT (9 M) FLOOR SPAN	40 FOOT (12 M) FLOOR SPAN
Up to 5 hp (Up to 3.7 kW)	A or B 2 0.25	B 3 1.0	B 3 1.0	B 3 1.5
5 thru 40 hp (3.7 thru 29.8 kW) 200 to 500 rpm (21 to 52 Rad/s)	B 3 1.5	B 3 1.5	B 3 1.5	B 3 2.5
500 rpm (52 Rad/s) & over)	B or C 3 0.75	C 3 0.75	C 3 1.5	C 3 2.5
Over 40 hp (Over 29.8 kW) 250 to 500 rpm (26 to 52 Rad/s)	B 3 0.75	C 2 1.5	C 3 2.5	C 3 2.5
500 rpm and over (52 Rad/s and over	B 3 0.75	C 3 1.5	C 3 1.5	C 3 2.5
Fan coil units	A 3 0.75	A 3 0.75	A 3 0.75	A 3 0.75

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manufacturer: All vibration isolation equipment shall be installed in accordance with the manufacturer's recommendations.

B. Manufacturer's Representative: The vibration isolation installation and deflection testing after equipment start-up shall be conducted by a representative of the manufacturer.

3.2 TESTS AND REPORTS

A. Testing: Each vibration isolation device shall be deflection tested. Two (2) copies of a bound report shall be submitted prior to final acceptance. The certification shall include the following:

1. Certify that equipment has been isolated in accordance with Contract Drawings, specifications and submittals.
2. Certify that all minimum specified deflections have been equaled or exceeded.

3.3 ANCHORING

A. Installation: Installation shall comply with manufacturer's published recommendations and shall be installed so that isolators are plumb and are operating at a manner for which they were designed.

1. Unless otherwise specified, all equipment shall be securely bolted to isolators, steel bases or concrete inertia bases.
2. Indoor vibration isolators need not be attached to the structure unless required by local codes.
3. Isolators installed outdoors shall be attached to building structure.

3.4 CLEANING

A. Debris: Remove all debris from under equipment, and thoroughly clean steel bases, inertia bases and check for free movement.

B. Adjustment: Adjust isolators as required for proper operation prior to starting equipment. Testing of vibration isolators shall be performed by a certified representative of the manufacturer as specified.

3.5 GENERAL

A. All exterior structural steel and/or steel housings of exterior vibration isolation materials shall be hot dipped galvanized.

END OF SECTION 23 05 48

SECTION 23 05 49

SEISMIC AND WIND CONTROLS - HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section specifies the minimum requirements for restraining HVAC systems and equipment.

B. The requirements of this section must be coordinated with the requirements of Division-23 section, Vibration Isolation for HVAC Piping and Equipment.

C. This Section includes the following:

1. Restrained elastomeric isolation mounts
2. Restrained spring isolators
3. Restrained vibration isolation roof curb/rail assemblies
4. Restraint snubbers
5. Restraining braces and cables
6. Flexible connectors for restraint applications

1.3 APPLICABLE STANDARDS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

D. ASCE-7: Minimum Design Loads for Buildings and Other Structures.

1.4 PERFORMANCE REQUIREMENTS

A. All components mounted outside of the building structure shall be mounted to resist minimum wind loads per IBC requirements.

B. Wind-Restraint Loading:

1. Basic Wind Speed: See Structural Drawing General Notes.
2. Building Classification Category: See Structural Drawing General Notes.

3. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

C. All HVAC components shall be mounted to resist seismic loads per IBC requirements.

D. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: See Structural Drawing General Notes.
2. Assigned Seismic Building Risk Category as Defined in the IBC: See Structural Drawing General Notes.

a. Component Importance Factor: See Schedule in Part 3 of this Section.
b. Component Response Modification Factor: Per ASCE-7 Table 13.6-1.
c. Component Amplification Factor: Per ASCE-7 Table 13.6-1.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): See Structural Drawing General Notes.
4. Design Spectral Response Acceleration at 1.0-Second Period: See Structural Drawing General Notes.
5. See Geotechnical Report for additional requirements.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of restraint component used.

B. Delegated-Design Submittal: For restraint details indicated to comply with performance requirements and design criteria, include project specific load analysis data signed and sealed by the qualified professional engineer responsible for their preparations.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation and seismic and wind forces required to select restraints.
2. Seismic and Wind Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic and/or wind restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic and/or wind load events. Indicate association with vibration isolation devices.

c. Coordinate seismic and/or wind restraint details required for equipment mounted outdoors. Comply with requirements in other Division-23 Sections for equipment and components mounted outdoors.

d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES showing maximum ratings for concrete anchors (tests or calculations).

C. Coordination Drawings: Show coordination of seismic and/or wind load bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic and/or wind restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer.

F. Field quality-control inspection reports.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Restraint devices shall have horizontal and vertical load analysis and shall bear anchorage preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum restraint ratings. Submittals based on independent testing and/or calculations are acceptable. Calculations (including combining shear and tensile loads) to support restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements of this section, provide products by Kinetics Noise Control or Mason.

B. Provide appropriate product(s) from those listed below to meet the requirements of restraining or restraining/vibration isolating HVAC components.

2.2 COMBINATION RESTRAINT/VIBRATION ISOLATION DEVICES FOR NON-CURB MOUNTED EQUIPMENT

A. Restrained Rubber/Neoprene Mounts, Model RQ: All-directional restrained mountings.

1. Materials: Cast-ductile-iron or welded steel housing containing oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

B. Restrained Spring Isolators, Model FHS: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 150 percent of rated load, fully compressed, without deformation or failure.
5. Housing: Factory drilled for bolting to structure

C. Restrained Spring Isolators, Models FLS / FLSS: Freestanding, steel, open-spring isolators with limit-stop/restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 150 percent of rated load, fully compressed, without deformation or failure.

D. Side Mount Restrained Spring Isolator, Model FMS: Side mount spring isolator with integral restraint snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional restraint.
2. Base: Factory drilled for bolting to structure.
3. Equipment Mount: Factory drilled for bolting to the equipment.
4. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.
5. Overload Capacity: Support 150 percent of rated load, fully compressed, without deformation or failure.

2.3 COMBINATION RESTRAINT/VIBRATION ISOLATION DEVICES FOR CURB MOUNTED EQUIPMENT

A. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb and rail designed to resiliently support equipment and to withstand seismic and wind forces.

1. All of the components within the final product and including the final product are to be manufactured within the United States of America.
2. Complete curb and isolation assembly shall be stamped by a Professional Engineer licensed in the jurisdiction of the project.
3. Provide sloped and/or extended height curb assemblies as necessary to coordinate with roof slope and buildup.

B. Sheet Metal Restraint/Spring Isolation Curbs, Model KSCR: Upper frame shall consist of extruded aluminum top rail, shall provide continuous support for equipment, and shall be captive to resiliently resist seismic and wind forces. Lower support assembly to be constructed out of formed heavy gage sheet metal, shall have a means for attaching to building structure, contain a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches (50 mm) of rigid, glass-fiber insulation on inside of assembly.

C. Structural Steel Restraint/Spring Isolation Curbs, Model ESR: Upper frame shall consist of a structural steel C channel to provide continuous support for the equipment and provide a place of attachment to the equipment. The lower frame shall be constructed from structural steel and shall provide adequate support to resist seismic and wind loads. The springs shall be adjustable, restrained with 1/4-inch (6-mm) thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic/wind restraint.

    a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
    b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
    c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
    d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
    e. Overload Capacity: Support 150 percent of rated load, fully compressed, without deformation or failure.

2. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

    a. Resilient Material: Oil- and water-resistant hermetically sealed compressed fiberglass.

3. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch (6 mm) thick.
4. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.
5. Extend height of curb as necessary to allow for spring isolator access after roof buildup is installed.

2.4 FLEXIBLE CONNECTORS TO ACCOMMODATE DIFFERENTIAL MOTION

A. Basis-of-Design Product: Subject to compliance with requirements of this section, provide flexible connectors to accommodate differential motion by Engineered Flexible Products (EFP) or equivalent.

B. General Requirements for Flexible Connectors to Accommodate Differential Motion:

1. Flexible connectors shall be chosen to accommodate differential motion caused where piping and duct crosses seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.
2. Flexible connectors shall not introduce any thrust loads into the distribution system and shall contain a welded on braid.
3. Flexible connectors shall be constructed of stainless steel braid with carbon steel end fittings and/or bronze braid with copper end fittings.
4. Flexible connectors shall be V-shaped and capable of accommodating up to 4 inches (100 mm) of differential motion from centerline.
5. Flexible connectors shall be supplied by restraint supplier as part of restraint system.

2.5 SEISMIC AND WIND RESTRAINT DEVICES

A. General Requirements for Concrete Anchoring Components:

1. Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.
2. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be per IBC.

B. Snubbers, Model KSMS / KSMG: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismically rated, with an ICC-ES report.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.

C. Cable Restraint Kit, Model KSCU, KSWC, or KSCC: A pair of pre-stretched steel cables with end connections made of steel assemblies with thimbles (if vibration isolation is needed), brackets, swivels, and bolts designed for restraining cable service.

1. Kit shall include all hardware required for connection to the equipment/system.
2. Kit shall include a tool-less connector to avoid cable cutting and saddle clamps where possible.
3. Cables shall have one end pre-swaged from the manufacturer.
4. Cable size shall be 2 mm, 3 mm, 5 mm, and/or 6 mm in diameter depending on calculated design load.

5. Building and equipment attachment brackets at each end of the cable shall be designed to permit free cable movement in all directions up to a 45-degree misalignment. Protective thimbles shall be used at sharp connection points as required to eliminate potential for dynamic cable wear and strand breakage.

D. Hanger Rod Stiffener, Model KHRC: Clamp for attaching reinforcing steel angle to hanger rod.

E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

G. Resilient Isolation Washers and Bushings, Model TG: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

H. Mechanical Anchor Bolts, Model KCAB/KCCAB/KUAB: Select anchor bolts with strength required for anchorage and as tested according to ASTM E 488. Minimum length of anchor to be eight times diameter.

1. Anchor bolts to be zinc-coated steel for interior applications and stainless steel for exterior applications.
2. For equipment that is rigidly mounted and has 10 horsepower or less use drilled-in and stud-wedge or female-wedge type anchor.
3. For equipment that is rigidly mounted and has greater than 10 horsepower, use undercut anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved by Professional Engineer of record for the project.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on delegated design drawings to receive them and where required to prevent buckling of hanger rods due to seismic and/or wind load forces.

C. Strength of Support and Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic and/or wind loads within specified loading limits.

3.3 SEISMIC AND WIND RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in architectural specifications for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install restraint snubbers on equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Combination restraint/vibration isolation devices may be installed in lieu of separate vibration isolators and restraint snubbers if they conform to all requirements of this specification and Division-23 Section, Vibration Isolation for HVAC Piping and Equipment.
3. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
4. Install restraint devices using methods provided by restraint supplier and required submittals for component.

C. Piping Restraints:

1. Comply with requirements of restraint system manufacturer.

D. Ductwork Restraints:

1. Comply with requirements of restraint system manufacturer.

E. Piping Riser Restraints:

1. Comply with requirements in SMACNA.
2. Restrain per sections 3.03.A and 3.03.B.

F. Install cables so they do not bend across edges of adjacent equipment or building structure.

G. Install restraint devices using methods approved by the restraint supplier required by the submittals for the component.

H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges/webs of beams, at upper truss chords of bar joists, or at concrete members.

K. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping and duct where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

B. Flexible connections to be supplied by restraint supplier.

3.5 FIELD QUALITY CONTROL

A. Inspections:

1. Verify isolator restraint clearance.
2. Verify snubber minimum clearances.
3. Verify ten percent of all cable restraints to ensure the angle of the restraints is installed properly.
4. Verify ten percent of all hanger rod locations where hanger rod stiffening is indicated in coordination drawings to ensure hanger rod stiffeners are installed properly.

3.6 ADJUSTING

A. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

B. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 SEISMIC-RESTRAINT DEVICE SCHEDULE

A. See chart below for component importance factor.

ITEM	IMPORTANCE FACTOR
PACKAGED ROOFTOP EQUIPMENT	1.5
AIR HANDLING UNITS	1.5
PUMPS – INLINE	1.5
PUMPS - BASE MOUNTED	1.5
CHILLERS	1.5
BOILERS	1.5
FANS – CENTRIFUGAL	1.5
FANS – AXIAL	1.5
FANS – INLINE	1.5
EXPANSION TANKS	1.5
HEAT EXCHANGERS	1.5
CONDENSING UNITS	1.5
UNIT HEATERS	1.5
CABINET HEATERS	1.5

END OF SECTION 23 05 49

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division-23 sections.

B. Types of identification devices specified in this section include the following:

1. Pipe and Duct Markers
2. Painted Identification Materials
3. Underground-Type Plastic Line Marker
4. Valve Tags
5. Valve Schedule Frames
6. Engraved Plastic-Laminate Signs
7. Plastic Equipment Markers
8. Plasticized Tags

C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. ANSI Standards: Comply with ANSI A13.1 or Owner standards for lettering size, length of color field, colors, and viewing angles of identification devices.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. All exposed and concealed piping above ceilings shall be identified with colored, pre-rolled, semi-rigid plastic labels. Labels shall be placed around the piping or insulation every twenty (20) feet and with one (1) label on each pipe in rooms smaller than fifteen (15) feet. A label shall be placed at every major valve and at least six (6) feet from exit or entrance to an item of equipment.

C. Labels shall have minimum three-quarters (3/4) inch high black letters for pipes (1) inch and larger, and one-half (1/2) inch letters for smaller pipes. All labels shall have flow arrows. Color coding and stencil designation shall be as indicated in 3.10.

D. Colors for the coding system shall be in accordance with ANSI A13.1-2007 standards. Prefabricated color bands shall be minimum two (2) inches wide. Markings shall be plain block letters, one (1) inch high on pipes three (3) inches and under in size, and two (2) inches high on pipes over three (3) inches, and shall be located near each branch connection, near each valve, and at least every twenty (20) feet on straight runs of pipe. Where pipes are adjacent to each other, markings shall be neatly lined up. All markings shall be located in such manner as to be easily legible from the floor.

E. Arrows with the same color scheme as letters shall indicate flow direction.

F. The Contractor shall furnish “Color Charts” listing piping systems service, color by name and a color sample for each piping service. These charts shall be furnished in a wood frame with glass suitable for hanging in Mechanical Rooms.

G. Labels shall be as manufactured by Seton, Pipe Marker or Brady. Labels shall be set around pipes with a field installed high strength cement compound applied along their longitudinal edge.

H. Maintenance Data: Include product data and schedules in maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers' products which may be incorporated in the work include the following:

1. Brady
2. Seton
3. Pipe Marker

2.2 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-23 sections. Where more than single type is specified for application, selection is Installer's option but provide single selection for each product category.

2.3 PIPE AND DUCT MARKERS

A. Snap-on Type: Provide pre-printed, semi-rigid, snap-on color coded identification sleeves complying with ANSI A13.1. This type shall be used for insulated pipe sizes 2” and smaller.

B. Pressure Sensitive Type: Provide pre-printed, permanent adhesive, color coded, pressure sensitive, vinyl markers conforming to ANSI A13.1. This style marker shall be applied to all uninsulated piping; insulated piping 2-1/2” and larger, and all ductwork.

C. Flow Direction: Provide flow directional arrows either as part of markers, or separately attached to pipes and ducts.

2.4 PAINTED IDENTIFICATION MATERIALS

A. Piping and Equipment Systems: Continuous color coded painting of piping and equipment shall be provided in all mechanical rooms in compliance with ANSI A13.1.

2.5 UNDERGROUND-TYPE PLASTIC LINE MARKER

A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" (150 mm) wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.

1. Provide multi-ply tape consisting of solid aluminum foil core between two layers of plastic tape.

2.6 VALVE TAGS

A. Brass Valve Tags: Provide 19-gage (1.2 mm) polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" (6 mm) high letters and sequenced valve numbers 1/2" (13 mm) high, and with 5/32" (4 mm) hole for fastener.

1. Provide 1-1/2" (40 mm) diameter tags, except as otherwise indicated.

B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.7 VALVE SCHEDULE FRAMES

A. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with lexan.

1. Locate one schedule where directed. Provide second schedule to Owner framed in rigid plastic frame with rigid plastic glazing.

2.8 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

1. Thickness: 1/16" (1.6 mm) for units up to 20 sq. in. (12900 mm^2) or 8" (200 mm) length; 1/8" for larger units.

B. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

C. Duty: Accident-prevention tags with appropriate wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

2.9 PLASTIC EQUIPMENT MARKERS

A. General: Provide manufacturer's standard laminated plastic, color coded equipment markers.

B. Nomenclature: Include the following, matching terminology on schedules as closely as possible:

1. Name and schedule number
2. Equipment service

2.10 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown on plans. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 DUCTWORK IDENTIFICATION

A. General: Identify air supply, return, exhaust, intake and relief ductwork with pressure sensitive markers and arrows, showing ductwork service and direction of flow.

B. Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 25 foot (7500 mm) spacings.

C. Access Doors: Provide duct markers on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.

3.3 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.

B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) exterior non-concealed, locations, and concealed gas piping.

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
4. At access doors, manholes and similar access points which permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing of 25 feet (7500 mm) along each piping run.

C. Gas Pipe: Paint exposed gas pipe throughout (except chromium plated).

3.4 UNDERGROUND PIPING IDENTIFICATION

A. General: During back-filling/top-soiling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" (150 to 200 mm) below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16" (400 mm), install single line marker.

3.5 VALVE IDENTIFICATION

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory fabricated equipment units, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

1. Tagging Schedule: Comply with requirements of "Valve Schedule" of this section.
2. All valves shall be tagged with a numbered tag, except those valves at mechanical equipment where their function is readily identifiable.
3. The tags shall be made of one (1) inch diameter brass fastened to the valve by means of stainless steel beaded chains. Valve tag numbers shall be indicated on the As-Built drawings and schematic diagrams.

4. Furnish a valve chart for each Mechanical Room with valve numbers indicating valve type, size, manufacturer and service.
5. The valve charts shall be mounted behind glass, wooden framed, and be hung in Mechanical Equipment Room or Custodian Office as directed by the Engineer.

3.6 MECHANICAL EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
2. Fuel-burning units including boilers and heaters.
3. Pumps, compressors, chillers and similar motor driven units.
4. Heat exchangers, coils, evaporators, heat recovery units and similar equipment.
5. Fans and blowers.
6. Packaged HVAC central-station and air handling units.
7. Tanks and pressure vessels.

B. All HVAC units (indoor and outdoor), outdoor condensing unit and other equipment shall be labeled and identified with suitable wording such as “AHU-1”, “ACCU-1”, “VAV-1” etc. Wording shall be consistent with wording on the Construction Documents.

C. Labels shall be plain block letters, stenciled two (2) inches high.

D. Hand written data is not acceptable.

E. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.7 CEILING GRID TAG FOR EQUIPMENT LOCATED ABOVE LAY-IN CEILING

A. Description: 3/4” x variable length” vinyl label, 3.0 Mil self-adhesive vinyl similar to Dura Label Pro. Label color shall be black test on a white background. The label shall provide a brief equipment description and equipment number.

B. All scheduled equipment and valves above finish lay-in ceiling shall be identified with an Equipment Tag.

C. All ceiling grid tags shall be installed prior to the ceiling cover inspection.

3.8 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.9 EXTRA STOCK

A. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

3.10 IDENTIFICATION SCHEDULE

SERVICE	DESIGNATION	COLOR
Chilled Water Supply	CHILLED WATER SUPPLY	BLUE
Chilled Water Return	CHILLED WATER RETURN	BLUE
Refrigeration Suction	REFRIGERANT SUCTION	YELLOW
Refrigeration Liquid	REFRIGERANT LIQUID	YELLOW
Heating Water Supply	HEATING WATER SUPPLY	YELLOW
Heating Water Return	HEATING WATER RETURN	YELLOW

END OF SECTION 23 05 53

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of testing, adjusting, and balancing (TAB) work required by this section is indicated on drawings and schedules, and by requirements of this section, and is defined to include, but is not necessarily limited to, air distribution systems, hydronic distribution systems, and associated equipment and apparatus of mechanical work. The work consists of setting speed and volume (flow), adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports to achieve the capacities or setpoints indicated on the contract documents, and recommending modifications to work as required to achieve the capacities or setpoints indicated on the contract documents.

B. Component types of testing, adjusting, and balancing specified in this section shall include, but not be limited to, the following as applied to mechanical equipment:

1. Building automated systems
2. Fans
3. Air handling units
4. Ductwork systems
5. Pumps
6. Chillers
7. Coils
8. Boilers
9. Piping systems
10. Terminal units
11. Heat exchangers
12. Domestic hot water recirc pump and associated balance valves

C. Refer to requirements of Division-26.

D. See drawings for pre-demolition testing requirements (where applicable).

1.2 QUALITY ASSURANCE

A. Tester's Qualifications: A firm certified by Associated Air Balance Council (AABC) who is not Installer of system to be tested and is otherwise independent of the project.

1. AABC Compliance: Comply with the current AABC's Manual "AABC National Standards", as applicable to mechanical air and hydronic distribution systems, and associated equipment and apparatus.
2. Industry Standards: Comply with AABC recommendations pertaining to measurements, instruments, and testing, adjusting, and balancing, except as otherwise indicated.
3. ASHRAE Standard 111: Comply with current edition of ASHRAE 111, “Measurement, Testing, Adjusting and Balancing of HVAC Systems”.

B. Pipe Testing Procedures: Contractor shall pressure test all piping systems in accordance with the following:

1. ASME Code for Pressure Piping B31, most current edition.
2. National Fire Protection Association (NFPA), all applicable sections, most current edition.

1.3 SUBMITTALS

A. Submit certified test reports, signed by the AABC Test and Balance technician who performed the TAB work. In addition, the report shall be certified by an AABC certified Test and Balance Engineer (T.B.E.) who is familiar with the project.

1. Include identification and types of instruments used, and their most recent calibration date with submission of final test report.

B. The Contractor shall maintain a copy of AABC standards on the site during all TAB work. Said document(s) shall be made available to Owner representatives for reference as to minimum requirements.

C. Maintenance Data: Include in maintenance manuals, copies of certified test reports, identification of instruments.

1.4 JOB CONDITIONS

A. Do not proceed with testing, adjusting, and balancing work until work has been completed, tested, operable, and all balancing devices indicated on the contract documents have been installed. Ensure that there is no residual work still to be completed on the equipment to be tested.

B. Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discarded building materials.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

A. Except as otherwise indicated, use same products as used by original Installer for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.

1. Factory fabricated plastic plugs shall be used to patch drilled holes in ductwork and housings.

2.2 TEST INSTRUMENTS

A. Utilize test instruments and equipment for TAB work required, of type, precision, and capacity as recommended in the following TAB standards:

1. AABC's Manual "AABC National Standards".

2. Wherever permanently installed measuring equipment is provided, such as air volume monitors, flow meters, temperature and pressure gages, etc., these shall be used in addition to TAB instrumentation. Any discrepancies in accuracy shall be brought to the attention of the Owner. Where permanently installed instrumentation meets accuracy requirements for TAB work, they may be used provided TAB Contractor can verify calibration of installed instruments.

B. The Contractor shall employ manufactured enclosure type cones, capable of air volume direct readings, for all diffuser air flow measurements.

PART 3 - EXECUTION

3.1 FIELD WORK

A. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned, operable and accessible. Do not proceed with TAB work until unsatisfactory conditions have been corrected.

B. Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable AABC standards. All systems and components shall be balanced within ±5% of design air and water flows.

C. Test, adjust and balance system during summer season for air handling systems and during winter season for heating systems, including at least period of operation at outside conditions within 3°F (2°C) wet bulb temperature of maximum summer design condition, and within 10°F (6°C) dry bulb temperature of minimum winter design condition. When seasonal operation does not permit measuring final temperatures, then take final temperature readings when seasonal operation does permit.

D. For fan systems, provide sheave replacements where required to achieve specified air flows.

E. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in manner recommended by original Installer.

3.2 REPORTS

A. Prepare report of test results, including instrumentation calibration reports, in format recommended by AABC standards. Provide a System Summary page(s) at the front of the report.

B. An interim/preliminary handwritten report shall be submitted to the Engineer for review prior to the formal submission of the report.

C. Test reports shall include, but not be limited to, the following information:

1. Air Handling Equipment Test:

a. Design Conditions: CFM, static pressure, motor h.p., outside air CFM, fan and motor RPM and fan motor h.p. for each fan.

b. Installed Equipment: Manufacturer, size, arrangement, class, motor h.p., volts, phase, cycles, and full load amps.
c. Field Test Results: Fan CFM, fan RPM, fan motor voltage, fan motor operating amps, fan motor operating b.h.p., total static pressure for each fan. In addition, where applicable provide external static pressure, air pressure drop across each coil, filter bank, attenuator, etc. (ie. provide total static pressure profile of each system), as well as leaving air temperature, outside air conditions (dry bulb/wet bulb) at time of test, coil flow data (GPM), coil entering and leaving air temperatures, coil entering and leaving water temperatures, coil water pressure drop, VFD settings at final test conditions, and duct static pressure setpoint. Air temperature difference measurements will not be acceptable.

2. Air Distribution Test: Main and major branch ducts and individual supply, return and exhaust terminals (VAV terminals, terminal reheat units, diffusers, registers and grilles):

a. Design Conditions: Ductwork: CFM, duct size. Air terminals, diffusers, registers, grilles: CFM, module size and inlet size.
b. Field Test Results: Ductwork: CFM, duct size, number of velocity readings, average velocity reading. Air terminals, diffusers, registers, grilles: CFM, module size and inlet size.

3. Pump Test:

a. Design Conditions: GPM, Head, RPM, motor h.p.
b. Installed Equipment: Manufacturer, size, type drive, motor h.p., volts, phase and cycles, full load amps.
c. Field Test Results: Shut-off head, discharge pressure, suction pressure, GPM, operating head, pump motor operating amps, pump motor operating b.h.p., VFD settings at final test conditions and differential pressure setpoint.

4. Heat Exchanger Test:

a. Design Conditions: GPM, water pressure drop, entering and leaving fluid temperatures. For chillers provide flow, pressure drop and temperature differential for chilled and condenser water, as well as compressor power input readings.
b. Field Test Results: GPM, water pressure drop, entering and leaving fluid temperatures and outside air conditions (dry bulb/wet bulb) at time of test. For chillers provide flow, pressure drop and temperature differential for chilled and condenser water, as well as compressor power input readings.

5. Miscellaneous Test Results:

a. All Coils: Air pressure drop, water pressure drop, water flow (GPM), air flow (CFM), entering water temperature, leaving water temperature, entering air temperature, leaving air temperature and outside air temperature at time of test (where applicable) and BTU calculations. Air temperature difference methods will not be acceptable.

b. Air Flow Monitors (AFM): Provide verification of AFM accuracy including set-up and adjustment required to verify proper operation and accuracy of each AFM system.
c. Sound Readings: Provide ten (10) sound power level readings at locations to be selected by the Engineer.

D. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced; including, where necessary, modifications which exceed requirements of contract documents for mechanical work.

E. Record outdoor air temperature (dry bulb and wet bulb) at the time of testing air handling units, chillers, boilers and any other equipment where performance is affected by outdoor air conditions.

F. Report shall include results of piping and ductwork tests indicated in paragraphs 3.3 and 3.4 of this section.

3.3 TESTS - PIPING

A. Prior to the balancing of systems by the AABC certified balancing contractor, the mechanical contractor shall air and/or hydrostatically test the following systems in accordance with the latest ASME B31 (ASME Code for Pressure Piping) and NFPA requirements.

1. Air Test:

a. Air, Gas and Vacuum
b. Refrigeration Liquid and Suction Line

2. Hydrostatic Test:

a. Chilled/Heating Water Supply and Return Piping

B. Pressure tests shall also be performed prior to the installation of all insulation materials.

C. Hydrostatic Test: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed, wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.

1. Required test period is four (4) hours.
2. Hydrostatically test each piping system at 150% of operating pressure indicated, but not less than 100 psi (690 kPa) test pressure.
3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds one percent (1.0%) of test pressure.
4. Prior to testing, verify the pressures listed above are in accordance with the latest ASME B31 code and NFPA. Should a discrepancy exist between the ASME B31 code, NFPA, and/or the pressures indicated above, contact the Engineer prior to testing.

D. Air Test:

1. Air, gas and vacuum piping shall be air tested at 200 psi (1380 kPa).
2. Refrigerant piping shall be air tested at 400 psi (2720 kPa).
3. Prior to testing, verify the pressures listed above are in accordance with the latest ASME B31 code and NFPA. Should a discrepancy exist between the ASME B31 code, NFPA, and/or the pressures indicated above, contact the Engineer prior to testing.

E. Drain test water from piping systems after testing and repair work has been completed.

F. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

3.4 TESTS - DUCTWORK

A. Prior to the balancing of systems by the AABC certified balancing contractor, all high pressure and low pressure systems shall be tested by the mechanical contractor for duct leakage. Duct leakage shall not exceed 1% of design cfm for a duration of ten (10) minutes. Test pressures shall be not less than the following:

Low Pressure Ductwork:	25% above system operating pressure, but not less than 2" w.c. (500 Pa)
High Pressure Ductwork:	25% above system operating pressure, but not less than 6" w.c. (1500 Pa)

Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet the above testing requirements.

Refer to Division-23 ductwork sections for systems indicated as low pressure or high pressure.

B. The balance contractor shall witness and certify all duct pressure tests.

3.5 TESTS - AUTOMATIC TEMPERATURE CONTROLS

A. The contractor shall verify calibration of all indicating, recording, controlling and controlled devices throughout the mechanical system. Verify the proper function of all installed equipment and devices and the interlocking of all new systems as required by the contract documents. Verify that each control device will a) control the valve, b) control the damper or c) control the apparatus/equipment it is designed to, in order to produce the specified results.

B. The complete verification of each control function shall be included in the final balance report and the operations and maintenance manuals. Verification of each control function shall include an itemized list of all mechanical equipment and associated control devices, the date of the verification and the initials of the individuals who verified the proper operation of the control function. At a minimum, two (2) individuals, the balance contractor and the control manufacturer, shall perform, witness and verify the proper operation of each

control function from central plant source equipment (chillers, boilers, air handling units, pumps, etc.) to each room control function (thermostat, control of VAV damper, reheat valve, etc.). Prior to the verification process, the Owner shall be given the option to provide representative(s) to witness the verification of any or all equipment/control functions.

C. A report including successful verification of all items indicated above shall be included in the Operations and Maintenance Manual.

3.6 FINAL TESTS, INSPECTION AND ACCEPTANCE

A. At time of final inspection, Contractor shall recheck, in presence of Owner's Representative, random selections of data (water and air quantities, air motion, and sound levels) recorded in Certified Report. In addition, courtrooms, auditoriums, and conference rooms shall be rechecked.

1. Points and areas for recheck shall be selected by Owner's Representative.
2. Measurement and test procedures shall be same as approved for work forming basis of Certified Report.
3. Selection for recheck (specific plus random), in general, will not exceed 25 percent of total number tabulated in report, except that special air systems may require a complete recheck for safety reasons.

B. Retests: If random tests elicit a measured flow deviation of 10 percent or more from, or a sound level of 2 db or more, greater than that recorded in Certified Report listings, at 10 percent or more of the rechecked selections, report shall automatically be rejected. In the event the report is rejected, systems shall be readjusted and tested, new data recorded, new Certified Reports submitted, and new inspection tests made, at no additional cost to the Owner.

C. Marking of Settings: Settings of valves, splitters, dampers, and other adjustment devices shall be permanently marked by the Contractor so that adjustment can be restored if disturbed at any time.

END OF SECTION 23 05 93

SECTION 23 07 00

HVAC INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, by requirements of this section, and all other Division-23 sections.

B. Types of mechanical insulation specified in this section include the following:

1. Piping System Insulation:

a. Fiberglass
b. Flexible Unicellular

2. Ductwork System Insulation:

a. Fiberglass
b. Polyisocyanurate

3. Equipment Insulation:

a. Fiberglass

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firms with at least five (5) years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories, and intended use for each mechanical system requiring insulation.

B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following:

1. Owens Corning
2. Johns Manville
3. Certainteed
4. Armacell
5. Knauf

2.2 PIPE INSULATION MATERIALS

A. Fiberglass Pipe Insulation: ASTM C 547-00, Type 1 (up to 850°F) (up to 454°C), maximum k-value of 0.23 BTU-in/hr-ft^2-deg F at a mean temperature of 75°F.

B. Flexible Unicellular Pipe Insulation: ASTM C 534, Type 1 (-40°F to 200°F).

C. Jackets for Piping Insulation: Jacket assembly shall be ASTM C 1136, Type I with vapor retarder (0.02 perms).

1. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
2. Encase exterior piping insulation with 26 gauge embossed aluminum jacket with weather-proof construction.

D. Bands, Wires and Cement: As recommended by insulation manufacturer for applications indicated.

E. Adhesives, Sealer, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

2.3 DUCTWORK INSULATION MATERIALS (INDOOR)

A. Rigid Fiberglass Ductwork Insulation: ASTM C 612-00, Type 1A (up to 450°F) (up to 232°C), minimum k-value of 0.27 BTU-in/hr-ft^2-deg F at a mean temperature of 75°F (24°C).

B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type I, maximum k-value of 0.27 BTU-in/hr-ft^2-deg F or minimum "out of package" R-value of 6.7 at a mean temperature of 75˚F. For ductwork in ceiling space directly below roof, provide insulation with maximum k-value of 0.25 and minimum "out of package" R-value of 8.0 (1.5 LBS/FT^3 density).

C. Ductwork Insulation Accessories: Provide bands, wires, tape, anchors, corner angles, and similar accessories as recommended by insulation manufacturer for applications indicated.

D. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

2.4 OUTDOOR DUCT INSULATION SYSTEM (PRE-MANUFACTURED)

A. Pre-manufactured panel system shall consist of four (4) piece interlocking panels.

B. The interlocking panels shall be constructed of Dow Thermax polyisocyanuarate insulation, ASDTM D-1622, nominal 2 pcf; water vapor transmission permeance less than 0.03, per ASTM E-96; water absorption less than 0.3% (24 hours), per ASTM C-209; flexural strength more than 40 psi, per ASTM C-203

C. Operating temperature range of -100°F to +250°F.

D. Insulation shall be laminated in two (2) layers to provide an installed system value of R-16 at 2 inch thickness, per ASTM C-236/C-518.

E. The insulation shall be clad with 0.032" thick embossed aluminum and sealed with vapor barrier compound. All joints shall interlock to ensure a thermal seal with no pass through seams.

F. Panels shall be secured with #10 self-tapping stainless screws with weather seal washers.

G. Manufacturer: Techna-Duc Insulation System as manufactured by P.T.M. Manufacturing, L.L.C., Newark, Delaware.

2.5 OUTDOOR DUCT INSULATION SYSTEM (FIELD INSTALLED)

A. Field-installed insulation system shall consist of two inches of elastomeric foam insulation clad in 0.032 embossed aluminum weather barrier delivering an installed thermal value of R-8.

B. The insulation material shall be elastomeric foam insulation, ASTM C-534, water vapor transmission permeance 0.08, per ASTM E-96, procedure A; water absorption 0.2% (24 hours), per ASTM C-209.

C. Operating range of -100°F to +250°F.

D. Insulation shall be applied in two (2) offset and overlapping layers to provide an installed value of R-8 at 2: thickness, per ASTM C-236/C-518. A minimum of 1" thickness shall be maintained at all joint locations to maintain a thermal efficiency of R-4. Insulation shall be fully adhered to the cleaned, oil free duct substrate utilizing an approved contact adhesive. All butt edge seams shall be likewise fully adhered.

E. The insulation shall be clad with 0.032" thick embossed aluminum and sealed with vapor barrier compound. All joints shall interlock to ensure a thermal seal with no pass through seams.

F. Metal jacketing shall be secured with #10 self-tapping stainless screws or stainless steel pop rivets.

G. Manufacturers: Armacell, Rubatex.

2.6 EQUIPMENT INSULATION MATERIALS

A. Rigid Fiberglass Equipment Insulation: ASTM C 612-00, Type 1A (up to 450°F) (up to 232°C).

B. Jacketing Material for Equipment Insulation: Provide 8 ounce (227 g) canvas or pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard (263 g/m^2), or metal jacket at Installer's option, except as otherwise indicated.

C. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

D. Equipment Insulation Accessories: Provide bands, wire, wire netting, tape corner angles, anchors, stud pins as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 HVAC PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit insulation on hot piping within radiation enclosures or unit cabinets; on cold piping within unit cabinets provided piping is located over drain pan; on condensate piping between steam trap and union; and on unions, flanges, strainers, flexible connections, expansion joints, and air conditioning condensate piping in mechanical rooms and/or on roofs.

B. Sub-Zero Piping (Below 0 Degrees F) (Below -18 Degrees C):

1. Application Requirements: Insulate the following sub-zero HVAC piping systems:

    a. Low temperature refrigerant piping.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

    a. Flexible Unicellular: 1-1/2" (40 mm) thick for pipe sizes up to and including 2" (50 mm), 2" (50 mm) thick for pipe sizes over 2" (50 mm).

C. Sub-Freezing Piping (0 to 39 Degrees F) (-18 to 4 Degrees C):

1. Application Requirements: Insulate the following sub-freezing HVAC piping systems:

    a. Refrigerant suction lines between evaporators and compressors.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

    a. Fiberglass: 1" (25 mm) thick for pipe sizes up to and including 1" (25 mm), 1-1/2" (40 mm) for pipe sizes over 1" (25 mm).
    b. Flexible Unicellular: 1/2" (13 mm) thick or pipe sizes up to and including 1" (25 mm), 1" (25 mm) for pipe sizes over 1" (25 mm).

D. Cold Piping (40 Degrees F to ambient) (4 Degrees C to ambient):

1. Application Requirements: Insulate the following cold HVAC piping systems:

    a. HVAC chilled water supply and return piping.

2. Insulate each piping system specified above with the following type and thickness of insulation:

    a. Fiberglass: 1-1/2" (40 mm) thick for all pipe sizes. For interior chilled water applications, provide “Vaporwick” fiberglass insulation as manufactured by Owens Corning or equivalent.

E. Hot Piping (to 200 Degrees F) (to 93 Degrees C):

1. Application Requirements: Insulate the following hot HVAC system (water piping up to 200°F) (water piping up to 93°C).

    a. HVAC hot water supply and return piping.

2. Insulate each piping system specified above with the following type and thickness of insulation:

    a. Fiberglass: 1-1/2" (40 mm) thick for pipe sizes up to and including 1-1/4" (32 mm), 2" (50 mm) thick for pipe sizes 1-1/2" (40 mm) and larger.

F. Insulation of Piping Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by the manufacturer.

3.3 DUCTWORK SYSTEM INSULATION

A. Cold Ductwork (Below Ambient Temperature):

1. Application Requirements: Insulate the following cold ductwork:

a. Outdoor air intake ductwork between air entrance and fan inlet or HVAC unit inlet.
b. HVAC supply ductwork from fan discharge to diffuser or register, including all duct accessories (sound attenuators, etc.).
c. HVAC return ductwork located in ceiling directly adjacent to roof, including all duct accessories (sound attenuators, etc.).
d. HVAC supply and return ductwork located exposed in double-wall ductwork in occupied room.
e. HVAC plenums and unit housings not preinsulated at factory or lined.
f. Insulate neck and bells of supply diffusers.
g. External portions of air terminal (VAV, TRU's) heating coils.

2. Insulate each ductwork system specified above with the following type and thickness of insulation:

a. Flexible Fiberglass: 2" (50 mm) thick with R-value of 6.7 (provide 2" thick with minimum R-value of 8.0 for supply ductwork located in ceiling space directly below roof), application limited to concealed locations.
b. Rigid Fiberglass: 2" (50 mm) thick, application limited to ductwork exposed to view, including mechanical rooms.
c. Flexible Fiberglass: 1” (25 mm) thick for double-wall return ductwork exposed in occupied rooms.

B. Hot Ductwork (Above Ambient Temperature):

1. Application Requirements: Insulate the following hot ductwork:

a. Hot supply and return ductwork between fan discharge, or heating unit discharge, and room diffuser/register; except omit insulation on return ductwork located in return air ceiling plenums.
b. Heating plenums and unit housings not pre-insulated at factory.

2. Insulate each ductwork system specified above with the following type and thickness of insulation:

a. Flexible Fiberglass: 2" (50 mm) thick.

C. Kitchen Hood Exhaust Ductwork: Insulate kitchen hood exhaust ductwork with the following type and thickness of insulation:

1. Certainteed FyreWrap EZ 1.5, zero clearance insulation, or equivalent to achieve a 2 hour fire rating.

D. Outdoor Ductwork:

1. Application Requirements: Insulate the following ductwork:

a. All outdoor ductwork (including lined or double wall lined ductwork).

2. Insulate all outdoor ductwork in accordance with paragraph 204 or 2.5 of this section.

3.4 EQUIPMENT INSULATION

A. Cold Equipment (Below Ambient Temperature):

1. Application Requirements: Insulate the following cold equipment:

a. Portions of chillers required by manufacturer, including heads
b. Drip pans under chilled equipment
c. Chilled water pumps
d. Expansion tanks
e. Air separators
f. Buffer tanks and all chilled water system components.

2. Insulate each item of equipment specified above with the following type and thickness of insulation:

a. Rigid Fiberglass: 2" (50 mm) thick for surfaces above 35°F (2°C) and 3" (75 mm) thick for surfaces 35°F (2°C) and lower.

B. Hot Equipment (Above Ambient Temperature):

1. Application Requirements: Insulate the following hot equipment:

a. Boilers (not pre-insulated at factory)
b. Hot water storage tanks
c. Heat exchangers
d. Heating air separator
e. Hot water pumps
f. Metal flue outlet of each boiler

2. Insulate each item of equipment specified above with the following type and thickness of insulation:

a. Rigid Fiberglass: 2" (50 mm) thick, except 3" (75 mm) thick for low-pressure boilers and steam-jacketed heat exchangers.

C. Breeching, Stack, and Emergency Generator Insulation:

1. Application Requirements: Insulate the following breechings and stacks:

a. Breechings between heating equipment outlet and stack or chimney connection, except for double wall or factory insulated breechings.
b. Stacks from bottom to top except for factory insulated stacks.
c. Emergency generator exhaust.

2. Insulate each breeching, stack and generator exhaust specified above with one of the following types and thicknesses of insulation:

a. Rigid Fiberglass: 3-1/2" (89 mm) thick.

3.5 INSTALLATION OF PIPING INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

1. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet pressure testing requirements indicated throughout these specifications.

B. Install insulation on pipe systems subsequent to installation of heat tracing, testing, and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage. Staples shall not be used.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Provide factory molded insulation for all valves, fittings, unions, etc. Valve handles must be extended by the mechanical contractor to accommodate the insulation without reducing the thickness or integrity of the valve insulation.

G. Extend piping insulation without interruption through pipe hangers, walls, floors and similar piping penetrations, except where otherwise indicated.

H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" (75 mm) wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" (75 mm) wide vapor barrier tape or band.

I. All exposed pipe insulation, including fittings, above 8'- 0" (2400 mm - 0 mm) of finished floor shall have 8 oz. (227 g) fire retardant canvas cover neatly cut and parted seams shall be sealed.

J. All exposed pipe insulation, including fittings, within 8' - 0" (2400 mm - 0 mm) of finished floor or within a stairwell, shall be provided with aluminum or PVC protective covers. All edges shall be hemmed and all seams shall be concealed.

K. All exterior piping shall be provided with an embossed aluminum jacket.

L. For all insulated piping 2-1/2” (63 mm) and larger, provide insulated saddles as follows:

1. For chilled water, as well as heating water, provide the following:

    a. Minimum 3.5 pcf, non-compressive, rigid, phenolic foam insulation. Fire and smoke rating shall be 25/50 or below per ASTM 84.
    b. For cold applications below 75ºF (24ºC) a zero permeability abuse resistant vapor barrier shall be provided with matching butt strips. Apply a full coating of butyl joint sealant in addition to the butt strips for a completely sealed system.
    c. The phenolic foam system shall have a K factor of 0.16 at a mean temperature for 75ºF (24ºC) and comply with ASTM Standard C1126.
    d. Provide visible inspection sticker at the bottom of each saddle.
    e. Pipe insulation saddles shall be Tru-Balance CoolDry Saddles as manufactured by Buckaroos, Inc. or equivalent.

3.6 INSTALLATION OF DUCTWORK INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

1. Insulation materials shall <u>not</u> be applied until systems have been witnessed, documented, and submitted to meet pressure testing requirements indicated throughout these specifications.
2. Install insulation materials with smooth and even surfaces.
3. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
4. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage. Seal all joints with vapor barrier material.
5. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

B. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound lining has been specified.

C. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

3.7 INSTALLATION OF EQUIPMENT INSULATION

A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

1. Insulation materials shall <u>not</u> be applied until systems have been witnessed, documented, and submitted to meet pressure testing requirements indicated throughout these specifications.
2. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.

3. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
4. Do not apply insulation to equipment, breechings, or stacks while hot.
5. Apply insulation using staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.
6. Coat insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.
7. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2" (50 mm). Apply over vapor barrier where applicable.
8. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
9. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

B. Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by manufacturer.

3.8 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division-23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

3.9 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

3.10 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 23 07 00

SECTION 23 08 00

COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Sections:

1. Section 019113 - "General Commissioning Requirements"

1.2 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the Commissioning Agent (CA).

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CA.

E. Provide information requested by the CA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.3 COMMISSIONING AGENT'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.4 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.

2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

3. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.

4. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.

5. Test and inspection reports and certificates.

6. Corrective action documents.

7. Verification of testing, adjusting, and balancing reports.

1.5 SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CA.

3.2 TESTING AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CA.

B. Notify the CA at least 3 days in advance of testing and balancing Work, and provide access for the CA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CA.

1. The CA will notify testing and balancing Subcontractor 3 days in advance of the date of field verification. Notice will not include data points to be verified.

2. The testing and balancing Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.

3. Failure of an item includes a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. Remedy the deficiency and notify the CA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CA.

B. Scope of HVAC&R testing shall include the conditioned common areas and living spaces for this project. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CA along with the HVAC&R Subcontractor, testing and balancing Subcontractor, and HVAC&R Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CA may direct that set points be altered when simulating conditions is not practical.

H. The CA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified on the mechanical drawings. Assist the CxA with preparation of testing plans.

B. The commissioning plan lists the specific equipment to be commissioned.

END OF SECTION 23 08 00

SECTION 23 09 00

AUTOMATIC CONTROL SYSTEMS (ELECTRIC-ELECTRONIC)

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: The extent of automatic controls work is indicated on the drawings and schedules and by the requirements of this Section, and all other Division-23 sections. The work includes, but is not limited to the following:

1. The provision of a complete and operational control system, including all devices necessary to perform the functions herein described or indicated on the drawings.
2. The new system shall include components to permit web-based interface with Baltimore County's central control and monitoring system in Glen Arm, Maryland.
3. The provision of 120 and 208 line voltage and 5 and 24 volt low voltage wiring and conduit types shall be installed in accordance with Division-26 of these specifications.
4. The ATC contractor shall furnish and install all electrical wiring and conduit from power source, including termination, to all required ATC related power connections including, but not limited to, DDC controllers (provide low voltage controllers for air terminal units including transformers and disconnect switches as required), sensors, valve and damper actuators (including smoke dampers), air flow monitors, ATC panels, etc. The ATC contractor shall obtain a separate electrical permit as required by the local authority. The ATC contractor shall be wholly responsible for all power requirements necessary for a complete installation from the power source to all ATC related connections. The intended power source shall be coordinated with, and approved by, the electrical engineer. All electrical work shall be installed in accordance with Division-26 of these specifications.
5. The ATC contractor shall interface with fire alarm devices as required to accomplish equipment shutdown, alarms, etc. indicated in sequences.
6. The ATC contractor shall coordinate and verify that all controllers, devices, and accessories are provided as required to accomplish all control functions and sequences indicated in the contract documents. Where control related devices are not provided by an equipment manufacturer, it shall be the responsibility of the ATC contractor to provide the control devices required to accomplish the functions and sequences indicated.
7. All drilling, cutting and patching associated with the installation of control systems.
8. ATC panel and electrically powered components shall be connected to the generator power system.

B. Types: Provide automatic control systems of the following types:

1. Direct Digital Control (DDC) with electric actuation of valve and damper actuators.

1.2 QUALITY ASSURANCE

A. Systems Engineering: The systems engineering phase shall include the selection and integration of components into a complete system which will meet the performance and prescriptive requirements of the Contract, together with drawings, specifications, descriptions of operation, diagrams and other materials listed under "Submittals" paragraph of this Section.

B. Testing and Adjusting During and After Installation:

1. The testing and adjusting includes the submission of a test plan which shall describe in detail the method by which each component, subsystem, and system will be tested, calibrated, adjusted, and retested after installation in accordance with the specified sequences of operation and other characteristics of the control system. A report on test results, including set points and operating ranges of all components shall be submitted.
2. The testing specified in this paragraph shall not replace the testing specified in "Commissioning Tests and Verification" article of this Section.

C. Commissioning Testing and Verifications: The final phase of the quality assurance program of the project is the commissioning testing and verifications. This phase is to assure that the project is fully completed and that the systems are performing in accordance to specifications from end to end of the control systems. Demonstrations of the automatic control systems to the commissioning team in accordance to the requirements specified in Part 3 of this Section are required. A report on test results, including set points and operating ranges of all components, shall be submitted.

D. Testing: The testing phase of quality assurance includes the submission of a test plan which shall describe in detail the method by which each component, subsystem, and system will be tested, calibrated and retested after installation to perform in accordance with the specified sequences of operation and other characteristics of the control system.

E. Reporting and Demonstration: This phase shall include the submission of a written report describing the "actions taken during the testing" phase, and including the set points and operating ranges of all equipment and a demonstration that the system performs in accordance with contract requirements.

F. Operating Instructions and Training: This phase of quality assurance includes the training of operating personnel utilizing written operating instructions prepared and approved under the "Submittals" paragraph of this Section, and the mounting of laminated control diagrams where directed.

G. Maintenance Manuals: This phase includes the submission of four hard bound copies of all manufacturers' cuts, maintenance and operating instructions, test reports and demonstration material, copies of control diagrams, and copies of the manufacturers' certifications.

1.3 SUBMITTALS

A. Shop Drawings: For each system to be controlled, prepare a drawing which includes a system flow diagram, control diagram, sequence of operation and schedule of components. Control diagrams shall be complete with end-to-end connections of piping and wiring from component terminal.

B. Manufacturer's Data: For each manufactured device or subsystem submit manufacturers' specifications and printed photograph of the proposed device or subsystem. Include engineering descriptions, principle of operation and application, and proposed model, style or size clearly indicated.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. The automatic temperature controls shall be furnished, installed, commissioned and warranted by one of the following acceptable providers:

1. Johnson Controls, Inc. - Factory Branch Office - Sparks, MD
2. Siemens Building Technologies - Factory Branch Office - Baltimore, MD
3. Honeywell – Factory Branch Office - Baltimore, MD

No distributors, wholesalers or manufacturers' representatives other than those listed above will be acceptable. In addition, manufacturers not listed above will not be acceptable.

2.2 SYSTEMS INTEGRATION

A. Control Loop Characteristics: Carefully evaluate the characteristics of each control loop, the time constants, equipment characteristics, control accuracy, and reliability and provide a system which will operate smoothly, without hunting, and within the accuracies specified.

B. System Components: Select components including sensors, transmitters, controllers, control devices, actuators, and instrumentation considering such factors as hysteresis, relaxation time, span, limits, and response time.

2.3 CONTROLLERS

A. General: Provide electric or electronic controllers for each local control loop.

1. Provide controllers with local adjustable setpoint, adjustable proportional band for analog controllers or adjustable differential for two position controllers.
2. Provide adjustable secondary input authority for dual input controllers with remote setpoint adjustment.
3. Provide integral or test connections for measuring input and output signal.

B. Electric/Electronic System Characteristics: Provide a system of control which shall have all of the following system characteristics. Systems which do not conform to all of the following requirements will not be acceptable.

1. The system shall consist of multiple, field adjustable controllers. The controller, power supplies, input/output and other components specified, including metal cabinet will be referred to as a "Field Panel."
2. The field panel shall be capable of performing its assigned local loop control and other functions as a standalone unit. It shall perform all specified local loop control functions without interaction to other field panels, except for shared functions such as central time programs, heating-cooling changeover, etc.
3. The field panel shall utilize control algorithms that permit proportional, integral, and derivative control as required. Control algorithms shall permit one, two or three mode control as specified or indicated on the drawings.
4. Each field panel shall be capable of handling multiple control loops, with one or more controllers.
5. The system shall utilize industry standard sensors.
6. The field panel shall provide both analog and binary output control. Analog outputs shall be compatible with industry standard transducers. Provide a modulating analog output control signal. Binary output control commands shall be implemented through interposing control relays.
7. Field panels shall be of modular construction. The system shall utilize interchangeable components. The modular construction of the system shall permit quick repair, ease of expansion, and the use of standard controls.
8. Each field panel with sensors and controlled devices shall be capable of automatic, unattended restart in the event of electrical power failure. In the event of electrical power failure all controlled devices shall move to their predetermined "normal" positions. By normal, it is meant that spring-close valves shall close, spring-open devices shall open, spring return devices will return and magnetically held devices will move to the position dictated by the force of gravity. Upon the restoration of electrical power, the field panel shall automatically restart and provide control to its connected systems after power failures of up to 72 hours.
9. The field panel operating system shall reside in nonvolatile memory.
10. Site specific application data, setpoints and operator entered data shall be stored in volatile memory.
11. Nonvolatile memory shall include PROM, EPROM, EAROM, ROM and RAM.
12. The preceding terms describe a class of solid state semi-conductor memories manufactured with LSI (large-scale-integration) techniques. These terms are expanded as follows:

    a. PROM - Programmable Read Only Memory
    b. EPROM - Erasable PROM
    c. EAROM - Electrically Alterable ROM
    d. ROM - Read Only Memory
    e. RAM - Random Access Memory

C. Field Panels: Provide field panels as follows.

1. Each field panel shall consist of a controller, power supplies, input/output modules, and other components specified.
2. Provide field panels where indicated. Provide additional controllers, if required, to support the control loops specified, the sequence of operations, number of monitoring points or other criteria to permit the field panel capacity to meet the specified functional requirements of the project.

3. Each field panel shall be capable of operation as a completely independent unit.
4. Each field panel or controller shall include its own operator's keypad or other means of adjustment on site by the operator.
5. Each field panel shall receive signals from industry standard sensors and input devices. Each panel shall have the capability to monitor the following types of inputs:

    a. Analog inputs: 4 to 20 mA and 0 to 10 V DC.
    b. Binary inputs: Dry contact closure and pulse accumulator.
    c. Provide transducers and/or signal conditioning to adapt other sensor types.
    d. Field panels that permit the direct connection of resistance type sensors will be acceptable if the system accuracy, data resolution, value accuracy and sensor interchangeability, comply with all other requirements of the specification.

6. The field panel shall directly control actuators and control devices. Each field panel shall be able to provide the following control outputs:

    a. Binary outputs: Contact closure
    b. Analog outputs: 4 to 20 mA, 0 to 10 V DC and 0 to135 OHM.
    c. Systems that do not provide direct analog outputs will be acceptable providing that they generate the specified output signal through transducers.

7. Each field panel shall perform control functions and other routines, specified under Sequences of Operation.
8. Each field panel shall accept binary inputs, on-off, open-close, or other two state data. Provide isolation and protection against input voltage up to 180 VAC peak.
9. Each field panel shall provide Binary Output by contact closures for momentary and maintained operation of field devices. Provide electromagnetic interference suppression on all output lines to limit transients to non-damaging levels. Provide isolation and protection against voltage up to 180 VAC peak. Provide contacts rated for 2 A at 24 VAC.
10. Each field panel shall be enclosed in a metal cabinet. The cabinet shall be constructed of 16 US gauge sheet steel, Provide sufficient access for wire and conduit to enter the cabinet. The cabinet shall have a hinge door and a pin tumbler lock. All field panel locks for the project shall be keyed alike. The cabinet shall be shipped to the project for installation without electronics. The electronics shall be added at the time of wire termination and system commissioning. All control wiring and system communications shall be electrically terminated inside the field panel.
11. Provide a 15A duplex receptacle inside or immediately adjacent to the field panel. The receptacle shall be energized when power is disconnected from the field panel.
12. Ground the field panel and power supply with a minimum No. 12 THHN unbroken ground wire to the building earth ground system. There shall be a maximum of 5 ohms measured between the ground at the field panel and the building ground system.
13. Provide a master electrical power disconnect switch inside the field panel to disconnect all external power to the cabinet for maintenance and repair. The disconnect switch shall not affect the duplex receptacle hereinbefore specified.

14. Provide screw type terminal strips in the field panel for the termination of all field wiring. Lay out terminal strips in a neat and orderly fashion and label each termination. All wiring entering the panel shall be routed through the panel wireways in a neat and workmanlike manner, properly tied or laced and terminated.
15. Provide conduit and wire to connect the field panel to the nearest adequate source of emergency electric power.

D. Wire/Cable Labeling: Label wire and cable as follows.

1. Label each cable and each conductor within 6 inches (150 mm) of the termination point. Cable and wire identification shall match the wiring identification shown on the installation and record drawings.
2. Wire identification labels shall be securely affixed to the wire and shall be of the preprinted type providing a durable vinyl or plastic covering over the printed lettering.
3. Wire identification through color coding, embossed label tape, paper tags attached with string and handwritten labeling will not be acceptable.

E. Transient Protection: Provide transient protection as required by the manufacturer.

F. System Accuracy: Provide system accuracy in accordance with the following.

1. Each local system shall maintain end-to-end accuracy for one year from sensor to controlled device for the applications specified.
2. Space temperature with a range of 50°F to 85°F (10°C to 29°C) plus or minus 0.75°F (.4°C) for conditioned space; 30°F to 130°F (-1°C to 54°C) plus or minus 1.0°F (.6°C) for unconditioned space.
3. Duct temperature with a range of 40°F to 140°F (4°C to 60°C) plus or minus 1.0°F (.6°C).
4. Outside air (OA) temperature with a range of minus 30°F to plus 130°F (minus -1°C to plus 54°C) plus or minus 2.0°F; with a subrange of plus 30°F to plus 100°F (plus -1°C to plus 38°C) plus or minus 1.0°F (.6°C).
5. Water temperature with a range of 33°F to 100°F (1°C to 38°C) plus or minus 0.75°F (.4°C); the range of 100°F to 250°F (38°C to 121°C) plus or minus 2.0°F (1.2°C); and water temperatures for the purpose of performing BTU calculations using differential temperatures to plus or minus 0.5°F (.3°C) using matched sensors.
6. Pressure with a range for the specific application plus or minus 2.0 percent of range.
7. Flow with a range for the specific application plus or minus 3.0 percent of range, and flows for the purpose of BTU calculations to plus or minus 2.0 percent of range.

G. Accuracy and Stability: Equipment shall be selected for the appropriate range of the application. Equipment selected with ranges in excess of the application will be replaced at the Contractor's expense.

2.4 SENSORS

A. General: Provide analog sensors for temperature controllers. Provide sensors with an output signal that varies continuously with the sensed temperature, within a specified range, of the thermistor or resistance type.

B. Manufacturer: Temperature sensors shall be made by one manufacturer.

C. Space Sensors: Provide space or room sensors with base plates thru-bolted into masonry or wall studs, brushed cast aluminum or 16 gauge (1.6 mm) ground and polished Type 316 stainless steel covers.

D. Insertion Type: Stem or extended surface sensitive type with screw mounting plate and galvanized sheet steel insulation mounting box.

E. Immersion Type: Stem or tip sensitive type with threaded immersion well base.

F. Sensing Elements: Hermetically seal, except for bimetal type for room thermostats. Stem, tip or extended element shall be Type 304 stainless steel or annealed copper.

G. Casing: Casing shall be constructed of watertight, vibration-proof, heat resistant high strength phenolic or 316 stainless steel.

H. Sensor Wells: Provide 304 stainless steel, bronze, copper or monel machined wells, compatible with the immersion medium, and heat sensitive transfer material or liquid between sensor and well surface.

2.5 ELECTRONIC ANALOG SENSORS

A. Range: Sensors shall operate within the range of minus 30°F to plus 220°F (minus -34°C to plus 104°C) for heating, ventilating and air conditioning (HVAC) systems.

B. Accuracy: Provide electronic analog sensors with an accuracy of plus or minus 0.25°F (.14°C).

C. Time Constant Response: Provide sensors with a time constant response to achieve 60 percent of a step temperature change in six (6) seconds in air or water flowing at 3 feet per second (.9 m/s).

D. Interchangeability: Sensors of the same type shall be interchangeable without calibration.

2.6 PRESSURE SENSORS

A. Overpressure Protection: Provide pressure sensors impervious to instantaneous pressure changes of 150 percent of working pressure but not less than plus or minus 50 psig (340 kPa).

B. Adjustment: Provide sensors with external adjustable span, adjustable zero and pulsation suppression.

C. Finished Spaces: Conceal pressure sensors in recessed stainless steel housing with removable perforated brushed stainless steel cover.

D. Sensor Characteristics: Provide pressure sensors with the following characteristics:

1. Ambient Temperature: 40°F to 140°F (4°C to 60°C).

2. Isolation Valves: Provide pressure sensors with stainless steel needle isolation valves between each sensor and sensor pressure source. Provide differential pressure sensors with 3-valve manifold for isolation and nulling.
3. Provide switching type sensors with platinum alloy, silver alloy or gold plated wiping contacts rated for the application, voltage and power levels.
4. Provide valved calibration taps adjacent to each pressure sensor for calibration.

2.7 STATIC PRESSURE ANALOG SENSORS

A. Types: Provide diaphragm sensors with solid state pre-amplifier electronic systems.

B. Characteristics: Provide analog sensors with the following characteristics:

1. Sensor span shall be not less than 150 percent and not more than 300 percent of the working pressure.
2. Accuracy shall be 0.5 percent of calibrated span including combined effects of linearity, hysteresis and repeatability.

2.8 DIFFERENTIAL PRESSURE ANALOG SENSORS

A. Types: Provide differential pressure analog sensors of the solid state pre-amplifier types for electronic systems.

B. Characteristics: Provide sensors with the following characteristics:

1. Sensor span not less than 150 percent nor more than 300 percent of the working differential pressure.
2. Accuracy of 0.5 percent of calibrated span, including combined effects of linearity, hysteresis and repeatability.
3. Pressure sensor shall withstand overpressure of not less than 200 percent working pressure and full vacuum underpressure without damage, changes in sensor accuracy or deformation.

2.9 DEW POINT AND RELATIVE HUMIDITY SENSORS

A. Dew Point Sensors: Provide analog salt-phase transition or dual cooled mirror type sensors with an accuracy of plus or minus 3°F (1.6°C) dew point over the range of 10°F to 100°F (-12°C to 38°C) dew point.

B. Relative Humidity Sensors: Provide analog precision resistance or hydro-mechanical gauge type relative humidity sensors, with an accuracy of plus or minus 2 percent of relative humidity over a range of 10 to 90 percent relative humidity.

C. Shields: Provide 316 stainless steel weatherhoods and shields to protect outdoor sensors from sunlight, snow, ice, wind and rain and provide fan powered aspirator complete with wiring if recommended by the manufacturer.

D. Indoor Covers: Sensors located in public spaces shall have brushed 16 gauge (1.6 mm) 316 stainless steel covers or recessed aspirating boxes with Allen head screw mounting plate.

2.10 THERMOSTATS

A. Types: Provide electronic thermostats which operate in an analog proportional or binary two-position mode as required by the sequence of operation.

B. Mounting: Mount thermostats in non-public spaces except room thermostats.

C. Electric Analog Thermostats: Provide electric analog thermostat with the following characteristics:

1. Sensor shall be of the bulb or capillary type which shall actuate a 135 ohm 3-wire potentiometer for 0-10 VDC, or 4-20 milliamp proportioning control action of balanced bridge motor actuators.
2. Sensor shall have adjustable setpoint range of not less than 80°F (27°C) throughout the range of 0°F to plus 250°F (-18°C to plus 121°C).
3. Adjustable proportional band ranges from 3°F to 25°F (-16°C to -4°C) and capillary length of not less than 5 feet (1500 mm) shall be provided.

D. Electric Two Position Duct and Immersion Thermostats: Provide thermostats with bimetal or bulb and capillary type sensor actuating one or more switching contacts.

1. Contact shall be rated for the imposed load or shall be a pilot duty type and provided with a control relay.
2. Thermostats shall have adjustable setpoint throughout the range 0°F to plus 250°F (-18°C to plus 124°C).
3. Differential shall be adjustable from 3°F to 10°F (-16°C to -12°C) for each contact for refrigeration, boiler and industrial applications.
4. Fixed differential thermostats with differentials of 3 may be provided for On-Off control of unit heaters, ventilating fans and similar applications.
5. Provide capillary tubes in the 5 to 20 feet (1500 to 6000 mm) lengths to suit applications.

E. Freeze Protection Thermostats: Electric freeze protection thermostats shall be provided with capillary elements, and special purpose insertion elements not less than 20 feet (6000 mm) in length for the face of coils up to 80 square feet (7.4 m^2). Freeze protection thermostats shall have the following characteristics:

1. A freezing condition at any one foot length increment anywhere along the sensing element shall activate the thermostatic switch.
2. Switch shall require manual reset.

F. Weather Shields: Provide weather shields and outside air sensing elements with the following characteristics:

1. Mount elements and shields on the north face of the building or location out of direct sunlight.
2. Construct shields of 16 gauge (1.6 mm) 316 stainless steel with flanges bolted to a backplate with not less than four 1/4-inch (6 mm) diameter stainless steel bolts. Mount backplate to the building structure with expansion bolts.

3. Construct shields to inhibit solar effects. Construct shields in a rectangular box configuration with ventilating raintight louvers to preclude the entrance of snow, ice and rain. Design for crossflow and vertical air circulation.
4. Mount shields accessible for maintenance.
5. Seal wall penetration watertight.

2.11 PRESSURE CONTROLLERS

A. Types: Provide electric electronic pressure controllers of the analog or two-position type as required by the sequence of operation.

B. Analog Controllers: Provide controllers with proportional action plus integral and derivative control modes.

1. Provide sensing elements of the differential type measuring controlled medium and standard reference pressures.
2. Air static pressure controllers shall have slack diaphragms with standard ranges 0 to 6 inches water column (0 to 1500 Pa) and an adjustable proportional band range of 0.02 to 0.5 inches water column (5 to 125 Pa).
3. Sensing elements for duct applications shall be damped to preclude pulsation.
4. Water differential pressure controllers shall have a minimum range of 0 to 50 psig (0 to 345 kPa) or 0 to 250 psig (0 to 1725 kPa) as required by the application with adjustable proportional band of one to 25 psig (170 kPa). Sensing elements shall be diaphragm type with 3-valve manifold. Provide siphons and pressure snubbers.

2.12 ELECTRIC PRESSURE SWITCHES

A. Type: Provide bourdon tube or diaphragm type electric pressure switches with tamperproof adjustable set point and differential settings. Design switches for 200 percent overpressure and full vacuum underpressure without damage or accuracy impairment.

2.13 DAMPERS

A. Standards: Provide opposed blade and parallel blade factory fabricated dampers of extruded aluminum, galvanized steel or stainless steel with metallic anti-friction non-ferrous bearing in accordance with Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) standards.

B. Types: Use parallel blade dampers in mixing chambers and plenums. Use opposed blade dampers for volume control, face and bypass dampers, smoke dampers, fan discharge, and variable air volume control.

C. Pressure Rating: For fan systems less than 10-inch water gauge (2490 Pa) static pressure, design and construct dampers to withstand a pressure of 150 pounds per square foot (7.1 kPa) without damage, leakage, flexure, or distortion.

D. Leakage: Maximum air leakage rate for all dampers shall not exceed 10 cubic feet of air per minute per square foot (50 L/s/m^2) at atmospheric pressure when closed against a 4-inch water gauge (1000 Pa) static pressure.

E. Operators: Damper operators shall have sufficient power to open and close the dampers and limit the leakage to the specified rate. Power wiring shall be extended to operator by this contractor.

F. Shafts and Bearings: Provide cadmium plated steel shafts in permanently lubricated bronze sleeve bearings or permanently lubricated ball bearings.

G. Blade Sizes: Reinforced or ribbed blades shall not exceed 8 inches (200 mm) in width nor 48 inches (1200 mm) in length.

1. Flat or unreinforced blades will not be acceptable.
2. Damper sections exceeding 4 feet (1200 mm) in width or 4 feet (1200 mm) in height shall be constructed with multiple frames and linkages.

H. Frames: Construct frames of factory welded galvanized steel hot dipped after construction or bolted extruded aluminum frames.

1. Dampers larger than 8 square feet (.7 m^2) in area shall have corner bracing gussets at each corner welded to the damper frame.

I. Linkages: Provide linkages to uniformly transmit damper operating forces to each damper blade.

1. Construct linkages of galvanized or cadmium plated steel or stainless steel.
2. Bearings and joints shall be ball and socket or sleeve bearings of brass, bronze or stainless steel, with plated bolts and locking nuts.

J. Seals: Provide mechanically attached elastomer or neoprene blade tip seal along the full length of each blade edge and flexible stainless steel seals along damper blade ends where the blades abut the frame. Adhesives or staples will not be acceptable.

K. Damper Mounting: Mount dampers to casings and ductwork in conformance with SMACNA standards. Provide welded or bolted galvanized steel structural supports for dampers larger than 20 square feet (1.9 m^2). Through bolt damper frames to structural supports.

2.14 AUTOMATIC VALVES

A. Standards: For chilled water, low temperature hot water and low pressure steam provide valves conforming to ANSI B16.15, "Cast Bronze Threaded Fittings," Class 125 copper bearing steel, bronze, or ANSI B16.1, "Cast Iron Pipe Flanges and Flanged Fittings," Class 125 cast iron. Select valve pressure class minimum 150 percent of maximum working pressure.

B. End Connections: Provide valves with end connections as follows:

1. For chilled water, low temperature hot water and low pressure steam provide valves with flanged connections on sizes 2-1/2 inches (65 mm)

and larger and threaded connections on valves 2 inches (50 mm) and smaller.

C. Small Water Valves (1" and Smaller): For valves controlling low pressure and low temperature chilled or hot water sizes one inch and smaller, bodies shall be bronze, cast iron or stainless steel with screwed, union or flare connections.

D. Valve Trim: Provide valve trim as follows:

1. Stems shall be 316 stainless steel.
2. Disk and stuffing boxes may be bronze or 316 stainless steel.
3. For all valves 1-1/2-inch (40 mm) and larger, stems, disks, and seats shall be 316 stainless steel.
4. All non-metallic parts of hot water valves shall be designed for minimum 250°F (121°C) or 100°F (38°C) above system design temperature.
5. Leakage: Control valves shall provide tight shut off in the closed position at 150 percent of maximum working pressure.

E. Valve Characteristics: Select valves to provide equal percentage control of water and linear control of steam.

1. Butterfly valves that do not have "equal flow characteristics" will not be acceptable for modulating control.
2. For two-position, water application action, butterfly valves may be used, provided the differential pressure across the valve does not exceed 25 pounds per square inch (170 kPa).

F. Sizing: Provide valves of sizes indicated, or as herein specified.

1. Size steam valves with a pressure drop not to exceed 50 percent of the total differential between supply and return main at full indicated flow.
2. Size water valves with a maximum differential pressure not greater 10 feet (480 Pa) or 1/2 the loss through the controlled apparatus, whichever is greater.

G. Actuators: Provide actuators, sized by the manufacturer, of sufficient size and power to operate the valve under all conditions and to close the valve tight against maximum differential pressure.

1. Provide pilots for sequence operations, and cases where valve spring ranges have been increased to close off against system pressure.
2. Comply with requirements of "Actuators" paragraph of this Section.

2.15 ELECTRIC ACTUATORS

A. General: Provide electric motor driven actuators (operators) arranged "Fail Safe" in the event of power failure. Unless indicated otherwise, the fail position of each valve shall be the "last position" or "current position" at the time of failure. Design operators to be quiet in operation and function within a range 85 to 100 percent input power potential.

B. Electric Actuators: Provide hydraulic or gear type electric actuators.

1. When operated at rated voltage each actuator shall deliver the torque required for continuous uniform movement of the control device from limit to limit.
2. Provide an end switch to limit travel and design the actuator to continuously stroke without damage.
3. Operators shall function properly within a range of 85 to 120 percent of line voltage. For actuators with input power greater than 100 watts, gears shall be ground steel, oil immersed, shaft shall be hardened steel running in bronze, copper alloy or ball bearing and operator and gear trains shall be totally enclosed in dustproof cast iron, cast steel or cast aluminum housing.
4. Actuators with input power less than 100 watts may use fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings and pressed steel enclosures.
5. Two position actuators shall be of the single direction, spring return or reversing type.
6. Proportioning operators shall be capable of stopping at all points in the cycle and starting in either direction from any point.
7. Reversing and proportioning operators shall have limit switches to limit travel in either direction.
8. For actuators with greater than 400 watts input, provide totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.

C. Damper Operator Mounting: Mount damper operators where accessible for maintenance.

1. If located outside the duct or casing, mount operators on a 14 gauge (2.0 mm) reinforced support plate arranged to allow insulation between the support plate and the face of the duct or casing.
2. Brace damper operators rigid to show no deflection or movement over the full range of the damper stroke.

2.16 CONTROL PANELS AND CABINETS

A. Local Panels and Cabinets: Provide local control cabinets for each air handling unit, automatically controlled equipment such as pumps, fans, heaters and convertors, or groups of such equipment in a single mechanical equipment room.

B. Standards: Construct panels in conformance with UL 50, "Cabinets and Boxes," or similar approved construction, with backbox, full-sized piano hinged face, stainless steel lockable latch, and secure to the building construction.

1. Internally mount all controllers, relays, terminal boards, and miscellaneous control devices, on a removable panel.
2. Flush mount in the door all indicators, selector switches, remote setpoint adjusters, and pilot lights.
3. Cabinet internals may be factory or field wired and piped. Wire shall be neat, braced, and strapped flat to present a neat appearance and to easily trace wiring and piping from one device to another.
4. Floor mounted panels shall be bolted to 1-1/2-inch by 1-1/2-inch (40 mm by 40 mm) structural support channel, bolted to the floor and braced at the top.

2.17 SYSTEM DIAGRAMS

A. Mounting: Mount control diagrams adjacent to each local control panel on a furniture steel extension either bolted to wall or to an extension of the control cabinet structural support.

1. Control diagrams shall include system one-line diagram, system control diagram, sequence of operations, and schedule of control devices.
2. Diagrams shall be hermetically sealed in laminated 16 gauge (1.6 mm) plastic.
3. Diagrams shall be permanent, black on white background, not subject to fading when subjected to artificial or natural light. Diazo prints are not acceptable.
4. Diagrams shall represent the current, "as-built" status of the control system, after acceptance by the representative of the Owner.
5. Obsolete, out of date, or field modified diagrams shall be removed, and new current diagrams furnished.
6. Diagrams and devices on local control panels shall be identified with engraved phenolic nameplates, white on black, minimum 1/4-inch (6 mm) high block capital lettering, screwed or bolted to panel or mounting plate face. Adhesive attachments are not acceptable.

2.19 WIRING

A. General: Provide a complete system of electric wiring for temperature control apparatus including control power transformers and wiring to the transformer primary.

B. Insulation Level: Control circuit conductors which run in the same conduit as power circuit conductors shall have the same insulation level as adjacent power conductors.

C. NFPA 70: All wiring shall conform to the requirements of the NFPA 70.

1. All line voltage wiring, all wiring exposed and all wiring in equipment rooms shall be run in rigid or flexible conduit, metallic tubing, metallic raceways, or wireways.

D. Wiring: Wire for low voltage AC shall be minimum 300 volt insulated copper No. 18 AWG or larger conforming to NFPA 70, Type MTW, THHN or TFFN, installed in accordance with Division-26 of these specifications.

1. For low voltage DC and an electronic circuit carrying less than 0.5 amperes, cables of two or more conductors not smaller than No. 18 AWG solid copper or No. 18 AWG solid copper if not shielded may be used in lieu of individual wires. All line voltage wiring in equipment rooms and exposed locations shall be run in electrical metal tubing (EMT). MC cable or other flexible metallic conduit systems shall not be used in exposed locations. MC cable may be used in concealed locations only.
2. Cables carrying analog signals shall be shielded, if required by the manufacturer.
3. Cables shall be terminated in solder or screw type terminal strips.
4. Cables shall not be tapped at any intermediate points.
5. All wire shall be color coded or numbered for identification. Identify as indicated on shop drawings and "as-built" drawings.

6. Wire terminating in screw type terminal strips shall have pressure connectors conforming to UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors," or UL 486B, "Wire Connectors for Use with Aluminum Conductors."
7. Wire terminations without connectors or traveling pressure pads will not be accepted.

E. The contractor shall in no case combine control wiring (line or low voltage) with power wiring in the same conduit.

2.20 ACCESSORIES

A. Provide a PC based operator's workstation within the building at a location determined by the owner, including a flat screen monitor (minimum 21") and a color laser printer. Provide color graphics of all systems to be controlled, monitored and alarmed by the EMCS. Computer hardware and software shall be compatible with the most current version of the ATC vendor's software and graphics packages.

B. Provide a portable operating terminal for connection to the main DDC control panel. In addition, main panel shall be provided with modem connection.

2.21 EMERGENCY SHUT-OFF SWITCHES AND CO SENSORS

A. Boiler shut-off switch shall be guarded, red toggle type, single pole, rated 20 amperes at 120V VAC. Switch shall be enclosed in a single gang outlet box with red coverplate and legend to read "EMERGENCY STOP". A nameplate shall be provided to indicate the equipment served. The contractor shall route 3/4" conduit and control wires from each switch to boiler control panel. Coordinate wiring type and quantity with boiler manufacturer. Coordinate connection point in boiler control panel with boiler manufacturer.

B. Provide emergency shut-off switches for all boilers indicated on the drawings at each exit from the mechanical room. Switches shall be located at the interior or exterior of the room as determined by the authority having jurisdiction.

C. Provide carbon monoxide (CO) sensors adjacent to fuel-fired equipment. CO sensors shall alarm locally and at the EMCS.

2.22 FLOW SENSORS

A. General: Provide sensors for measuring flow in piping and ductwork that are compatible with static pressure and differential pressure analog of the electronic controllers served.

B. Turndown: Provide sensors with an output characteristic which gives a continuous mathematical function over the full range of flow from maximum to minimum required.

C. See specifications, this section, for required air and/or water flow monitor measurement characteristics.

D. Provide all necessary power and control wiring as required for complete and operational flow measurement systems interlocked with the building EMCS.

2.23 AIRFLOW MEASUREMENT SYSTEMS (AIRFLOW MONITORS)

A. The airflow measurement system (AFMS), including airflow monitor, sensors, controllers, transmitters, etc., indicated on the plans shall be capable of continuously monitoring airflow rates at each measurement location. The system shall consist of one or more airflow measuring devices and a single microprocessor based transmitter. The number of sensing points shall be as per manufacturer's recommendation for the specified application. The AFMS shall not require recalibration or adjustment over the life of the equipment.

B. The AFMS shall produce a single, linear, analog output signal for airflow, which can be measured by the host control system. The system shall have the ability to perform self-diagnostics and automatic zeroing to adjust the signal to zero at pre-determined time intervals, which eliminates all output signal drift due to thermal, electronic and mechanical effects. In the event of sensor failure, the system shall ignore the failed sensor(s), average the remaining sensors and continue to operate.

C. The total accuracy from the airflow measurement to the host controls, including sensing point averaging error, the sum of the sensor and electronic (transmitter) errors, etc. shall not exceed +/-2% of reading at both minimum and maximum airflow rates based on the manufacturer's published performance specifications for all devices. In addition, total system performance including sampling error, shall not exceed +/-5% of actual airflow. The installed accuracy, in accordance with manufacturer's recommendations, without field adjustment shall be as follows throughout the operating range:

1. Ducts and plenums: +/- 3% of reading
2. Outside air intakes: +/-5% of reading
3. Fan inlets: +/- 10% of reading

D. The sensors and electronics shall operate over a temperature range of +40 to 120°F for ducted supply or return applications and -20 to 120°F for outside air applications. The sensors and electronics shall operate at a relative humidity range of 0 to 95% (non-condensing) for ducted supply and return applications and 0-99% (non-condensing) for outside air applications.

E. For standard applications, sensors shall be constructed of materials that resist corrosion due to moisture or salt in the airstream. Aluminum probes shall be provided. Where the electronics are installed in a location exposed to potential wind driven rain or snow (including outside air plenum) provide a NEMA 4 enclosure for all electronics. In addition, a visual display shall be provided to illustrate airflow (CFM) and temperature.

F. Airflow measuring devices shall be UL listed as an entire assembly.

G. The manufacturer's authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans for conformance with installed accuracy requirements. A written report shall be submitted to the consulting mechanical engineer if any measurement locations will not result in specified installed accuracy requirements.

H. Prior to purchase or installation of the air flow monitor (AFM), the Contractor and/or AFM Product Representative shall review each equipment and/or duct mounted location to verify suitability for installation. Should there be any discrepancy regarding installation or performance, the Contractor shall notify the Engineer immediately.

I. Provide all necessary power and control wiring as required for a complete and operational air flow measurement system interlocked with the building EMCS.

J. Airflow measurement system manufacturers shall be limited to the following:

1. Ebtron (Gold)
2. Air Monitor Valo-probe with Veltron II transmitter
3. Tek Aire Vortek VT-5000

2.24 FLOW METER

A. Furnish and install flow meters where indicated on the drawings. Flow meter shall be a dual turbine insertion type flow sensor complete with all installation hardware necessary to enable insertion and removal of the flow meter without system shutdown. The dual turbine element shall have contra-rotating axial turbine elements, each with its own rotational sensing system, and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion. Paddle type rotors will not be acceptable. Rotational sensing of each turbine shall be accomplished electronically by sensing impedance change and not with magnetic or photo-electric means.

B. The sensor shall have a maximum operating pressure of 400 PSI, minimum operating pressure of 180°F (optional 300°F peak) and a pressure drop of less than 1 PSI at 17 feet per second flow velocity. Flow sensor shall have a 175:1 turndown ration. Accuracy shall be $\pm$ 0.5% of actual reading at the calibrated typical velocity, and within $\pm$ 2% of reading from 0.4 to 20 ft/s (50:1 turndown). Each sensor shall be individually wet calibrated and tagged accordingly against a primary volumetric standard accurate to within 0.1% and directly traceable to the U.S. National Institute of Standards and Technology (NIST).

C. The sensor shall have integral analog outputs of 0-10 VDC and 4-20 mA linear to within $\pm$ 0.1% of calibrated span for connection to the EMCS. The sensor shall also include three (3) integral frequency outputs (top turbine, bottom turbine, average frequency) for diagnostic purposes and for connection to peripheral equipment (local display, BTU meter, etc.). All outputs shall be linear with flow rate.

D. The turbine elements shall be constructed of polypropylene (optional polysulfone) with sapphire jewel bearings and tungsten carbide shafts. The flow sensor shall be constructed of plated brass (optional 316 stainless steel with an aluminum electronics enclosure and gasketed cover) (optional weathertight enclosure).

E. Flow meter shall be Model F-1210 as manufactured by Onicon or equivalent.

2.25 AIR HANDLING UNIT VENTILATION RESET CONTROL FOR AHU'S

A. Minimum Required Outdoor Airflow Setpoint - The outside air damper shall be controlled to deliver the required outdoor airflow to each individual VAV zone at all load conditions. The minimum outdoor airflow setpoint shall be determined using ASHRAE Standard 62-2010, Section 6.2. The actual outdoor airflow shall be as sensed by the airflow monitor (AFM) located at the outside air intake location.

B. The Zone Outdoor Airflow (Voz), Zone Primary Outdoor Air Fraction (Vp), System Efficiency (Ev), Uncorrected Outdoor Air Intake (Vou) and ultimately the Outdoor Air Intake Flow (Vot) shall be continuously recalculated utilizing the formulas and tables indicated in Section 6.2 of ASHRAE 62-2010. The minimum required outdoor airflow (Vot) setpoint shall be regularly recalculated (10 minute intervals - adjustable) based on the prevailing VAV zone conditions.

1. Air handling unit shall include demand controlled ventilation utilizing occupancy sensors. The breathing zone OA airflow for each VAV zone (Vbz) serving spaces with occupancy sensors shall have two setpoints; one for occupied, and the other for un-occupied (see VAV terminal schedule on the mechanical drawings for occupied/un-occupied Vbz airflows).

C. The minimum outdoor airflow (Vot) for each unit shall be reset as per the description above, however, the total minimum outdoor airflow (Vot) for all AHU's shall not be reset to a value less than 110% of the total building exhaust air flow rate.

D. The ATC submittal shall include a written sequence of operation and sample programming required to determine the minimum required outdoor airflow (Vot) setpoint.

E. Prior to final system acceptance, a trend log of actual air system operation over a typical forty hour period will be required for review by the engineer and owner. System operating conditions to be logged include: critical space ventilation fraction, system supply air flow, calculated outdoor airflow setpoint and actual measured outdoor airflow at 10 minute intervals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Tubing and Wiring: Provide wiring and conduit to connect the automatic control system components for an operational system.

1. Provide wiring in accordance with requirements indicated in this section.
2. Run wiring in straight lines, parallel to the lines of the building, and rack on factory furnished mounting blocks attached to the building structure. Where run buried in slabs provide long sweep rigid conduit bends extending 6 inches (150 mm) above the slab at slab penetrations.
3. Do not bury or conceal wiring beneath building insulation.
4. Locate wiring clear of access doors, accessible ceilings, lighting fixtures, walkways, or any location subject to damage or abrasion.

B. Identification: Label or code each field wire at each end, and each controller and controlled device.

1. Identification shall be permanent, robust, not subject to fading, and flameproof.
2. Permanently mark terminal blocks at wire termination points.
3. Identify each control device with an engraved laminated phenolic nameplate, white on black, lettering not less than 1/8-inch (3 mm) height, on 1-1/2-inch (40 mm) by 1-inch (25 mm) tag and brass interlocked chain secured to the control device. Name shall correspond with identification on the shop drawings.
4. Identify sensors, controllers, relays, either mounted in local or central control panels, or remote mounted with a similar name tag as specified above. Attach to or adjacent to controllers with stainless steel or brass screws or rivets. Adhesives will not be acceptable. Do not attach to removable controller covers.

C. Pipe Work: Mount strap-on sensors using helical screw stainless steel band clamp for strap-on thermostats, aquastats and other temperature switches on new piping for unit heaters and fan coil units after the pipe is cleaned to bright metal. Strap-on sensor may be used on piping up to 2-1/2-inch (65 mm) diameter. On pipe 3 inches (80 mm) and larger use pipe wells.

D. Pipe Wells: Install pipe wells above the horizontal to retain liquid heat transfer fluid in the well.

E. Valves: Install valves in piping with stems as vertical as possible but in no case less than 45 degrees from vertical. For soldered or welded connections, remove valve internals before mounting.

F. Electric Valves: Wire electric valves in accordance with NFPA 70 with not less than 2 feet (610 mm) of flexible liquidtight connector with watertight bushings at the valve actuator. Brace conduit to the building structure.

G. Pressure and Temperature Sensors: Install pressure and temperature sensors as follows.

1. Locate pressure and temperature sensing points sufficiently downstream from the control device to increase control loop time constant and minimize hunting.
2. Locate shut-off valves and 3-valve bypasses as specified in "Sensors" paragraph of this Section.
3. Locate sensors where accessible for maintenance and replacement.
4. Do not cover or conceal sensors with insulation.

H. Space Sensors: Install space sensors as follows.

1. Space sensor including space thermostats, aspirating thermostats, humidistats, pressure or differential pressure sensors shall be enclosed in cast brushed aluminum or 16 gauge (1.6 mm) brushed and ground stainless steel enclosures. Enclosures shall be tamperproof. Setpoint adjustment or settings shall not be visible or adjustable from outside sensor enclosure. Sensors shall be securely mounted and rigid.
2. Locate room thermostats and other room sensors approximately 48 inches (1200 mm) above the floor (or otherwise as required to meet the

most current ADA guidelines) on inside wall where they will respond to average conditions in the space.

3. Sensors mounted on outside walls, if unavoidable, shall be mounted on factory made insulated brushed stainless steel bases.
4. Provide thermostat/sensor guards in all areas subject to potential damage. Thermostat/sensor guards shall be clear, impact resistant lockable plastic or approved equivalent. Thermostat/sensor guards shall be provided in the following areas and other similar type spaces subject to potential damage: gymnasium, multi-purpose rooms, fitness areas, activity rooms, mechanical rooms, electrical rooms, etc.

I. Air Handling Unit Temperature Indicators: For each factory assembled central station air handling unit and field erected air handling unit, provide temperature indicators in the following locations.

1. Each outside air plenum.
2. Each return air plenum.
3. Each cooling coil inlet and discharge.
4. Each heating coil discharge.
5. Temperature indicators shall be so located that they may be read by an operator standing on the operator floor. Indicators more than 8 feet (2400 mm) above the floor shall be remote bulb type.

J. Duct Sensors: Select duct sensor locations to properly sense average air conditions, minimize vibration, avoid dead air spaces, and within velocity limits required by the manufacturer.

1. Provide velocity shields where required.
2. Securely mount or clamp averaging elements, maximum 3 feet (900 mm) on centers to the leaving side of coils and equipment. Insulate averaging elements from equipment and protect from vibration.
3. Provide separate duct flanges for each sensing device.
4. Provide gaskets or sealant where elements penetrate duct walls.
5. Mount sensor to allow easy removal and servicing without disturbing insulation or vapor barrier. Mount on standoff brackets to avoid condensation.
6. Coordinate the location for duct access doors downstream from each duct sensor.

K. Pipe Sensors: Provide wells for all sensors and indicators measuring temperatures in pressure vessels and piping.

1. Wells shall be stainless steel or bronze to match media requirements.
2. Verify working pressure of sensor wells.
3. Do not install wells in extension couplings.
4. Where pipe diameters are smaller than the well length, provide wells at piping elbow or tees to affect flow across the entire well area.
5. Wells may face upstream or downstream.
6. Angle wells to retain thermal fluid within the well.
7. Should wells restrict cross sectional pipe area to less than 70 percent free area, provide pipe increases at the well not less than 150 percent pipe diameter.

L. The ATC contractor shall interface with smoke detectors, smoke dampers and fire alarm devices as required to accomplish equipment shutdown, alarms, etc., as indicated in sequences.

M. For single phase motors, provide relays and/or contactors of appropriate horsepower and voltage rating as required to energize/de-energize equipment as indicated in sequences.

3.2 TEST PLAN

A. Test Plan: Prepare a written test plan indicating in a step-by-step, logical fashion, the procedures by which the automatic control system will be tested, adjusted, and checked.

B. Pre-Approval: Not less than six (6) weeks prior to testing, provide four (4) copies of the proposed test plan for approval. Meet and discuss the test plan, and make agreed changes to the written plan.

C. Content: Plan shall include, as a minimum, for each system and sub-system of the automatic control work the following:

1. System name.
2. List of devices with brief description of functional purpose of each.
3. A description of the expected signal values transmitted by the sensor.
4. A description of the expected signal values transmitted by the controller to the control device or actuator.
5. A description of the expected values of the control medium from limit-to-limit.
6. A description of the instrumentation required to test the system.
7. A description of the expected field adjustments for transmitter, controller, and control actuator should control parameters fall outside of expected values.
8. A log sheet or sheets on which expected and field read values will be recorded and final field read values indicating that the system is operating in accordance with contract requirements.

3.3 TESTS DURING AND AFTER INSTALLATION

A. Instrumentation and Control: Calibration test each controller as follows:

1. Disconnect the sensor input signal to the controller and provide a compatible test signal generator.
2. Simulate expected transmitter values and input to the controller. Record controller branch line values.
3. Examine control device and determine that the device is responding.
4. Simulate maximum and minimum transmitter signal values and verify minimum and maximum controller output values and control device minimum and maximum stroke range.
5. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedule, proportional relationship, reset relationship, and derivative reaction.
6. When the controller and control device portion of each loop are responding as designed, reconnect the sensor transmitter input line.
7. After mechanical equipment control becomes operational, perform an operational test of each control loop recording sensor, transmitter, controller input, controller output and control medium parameter.
8. Entire test shall be witnessed by an owner's representative.

9. Upon satisfactory test a copy of final test results shall be bound in the operating and maintenance manual.

3.4 COMMISSIONING TESTS, VERIFICATION AND FINAL REPORT

A. General: In addition to the tests required during and after installation of automatic control systems, the Contractor shall perform commissioning tests to verify that the entire automatic control systems are designed, installed, and adjusted to perform as required in the Contract. This phase is an extension, not a substitute, of the phase specified under the "Tests During and After Installation" article of this Section.

B. Calibration of Sensors and Verification of Control Operations: Demonstrate all calibration and tests specified in paragraphs "Instrumentation and Control" paragraph under "Tests During and After Installation" article of this Section, to the commissioning team.

C. Verify proper operation of each and every control sequence specified in Part 2 of this Section and shown on the drawings.

D. Verification of Electronic Controllers:

1. Verify the operation of the field panels. Demonstrate proper automatic restart of equipment after power restoration.
2. Verify each and every required application. They shall include, but not be limited to:

    a. All control sequences specified for each local loop
    b. Time of day scheduling
    c. Economizer control
    d. Unoccupied cycle

3. Verify the operation of the clock routine in the field panel.
4. Demonstrate proper system operation while setpoints and data are being modified.

E. System Accuracy: System accuracies for each control loop, from end-to-end, shall be no less than those listed in "System Accuracy" paragraph under "Controllers" article of Part 2 of this Section.

F. The complete verification of each control function shall be included in a final test report and the operations and maintenance manuals. Verification of each control function shall include an itemized list of all mechanical equipment and associated control device, the date of the verification and the initials of the individuals who verified the proper operation of the control function. At a minimum, two individuals, the balance contractor and the control manufacturer, shall perform, witness and verify the proper operation of each control function indicated on the drawings and/or specifications from central plant source equipment (chillers, boilers, air handling units, pumps, etc.) to each room control function (thermostat, control of VAV damper, reheat and/or radiation valve, etc.). Prior to the verification process, the Owner shall be given the option to provide representative(s) to witness the verification of any or all equipment/control functions.

G. Failure of Tests: Any test, verification, or demonstration fails to meet the specification requirements, the component of the automatic control system causing the control system failure, be it hardware, firmware or software, shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall be repeated.

H. Test Report: Upon satisfactory tests of the automatic control systems, a copy of final test results shall be bound in the operations and maintenance manual.

3.5 DEMONSTRATION AND TRAINING

A. Demonstration: After completion of testing as hereinbefore specified, provide demonstration and training of designated operating personnel (refer to Division-1).

1. Demonstration shall be performed.
2. Demonstration shall include the operation of the entire mechanical system under the control of the Contractor and shall include the start-up, operation, and shutdown of the system in accordance with the sequence of operation.
3. The operation of each device shall be performed in accordance with the written instructions contained in the operation and maintenance manual, a copy of which shall be available ten (10) working days prior to the test. No deviation from procedures in the operating manual will be permitted.

B. Failure to Perform: Should the system fail to perform in accordance with the requirements of the operation and maintenance manual, the system shall be repaired, recalibrated, retested as necessary, and a second demonstration performed.

1. Subsequent demonstrations shall occur until the automatic control system and all associated mechanical and electrical equipment are operating in accordance with contract requirements.
2. All testing, retesting, and recalibration shall be at no additional expense. The Contractor shall reimburse the expenses of the commissioning team for each test after the first.

3.6 INSTRUCTING OPERATING PERSONNEL

A. Instructors and Superintendent: Upon completion of the work and acceptance by the representative of the Owner, provide the services of an Instructor, who together with the superintendent specialist shall instruct designated operating personnel in the operation and maintenance of the automatic control system.

1. The services of the Instructor shall be available for not less than four 4-hour days of instruction.
2. The services of the superintendent specialist shall be available for not less than two 4-hour days.
3. Instructions shall be based upon the use of the operating and maintenance manual together with copies of the laminated control diagrams affixed adjacent to each local control panel.
4. Training and instruction will be witnessed. The witness shall monitor the entire training program and prepare a written report on the competency and effectiveness of instructors and the level of expertise of designated

operators. A report will be submitted recommending additional training at additional cost, if such is deemed necessary.

3.7 BUILDING MANAGEMENT AND CONTROL SYSTEM DEVICES AND POINTS

A. Provide all building management and ATC system controllers, devices, points, etc. as required to accomplish the control sequences and equipment functions indicated throughout the contract documents, including drawings and specifications. In addition, provide all controllers, devices, points, etc. as required to control, operate, monitor and alarm all equipment and devices indicated on the contract documents (including but not limited to: chillers, boilers, pumps, air handling units, fans, variable frequency drives, air volume terminal units, valves, dampers, flow measuring devices, sensors, etc.). All points shall be available through the Energy Management Control System (EMCS). See attached points list (where applicable).

B. Building management and control points shall include status for all mechanical equipment with equipment failures alarmed at the EMCS. In addition, furnish and install all points required to provide complete, color, system graphics of all mechanical systems and components indicated throughout the contract documents. All equipment and devices indicated throughout the contract documents shall be indicated at the operator's workstation (where applicable) and all end devices shall be individually controlled unless specifically indicated otherwise.

C. Building management and control system features for equipment and devices shall include, but not be limited to, the following where applicable: runtime, trend data, optimal start, scheduling, paging, system graphics, and internet access to graphic and text-based displays.

END OF SECTION 23 09 00

SECTION 23 21 13

HYDRONIC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of hydronic piping work is indicated on drawings and schedules, and by requirements of this section and all other Division-23 sections.

B. Applications for hydronic piping systems include the following:

1. Chilled water supply and return
2. Heating water supply and return

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of hydronic piping products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firm with at least five (5) years of successful installation experience on projects with hydronic piping work similar to that required for project.

C. Codes and Standards:

1. ASME Compliance: Fabricate and install hydronic piping in accordance with ASME B31.9 "Building Services Piping".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for hydronic piping, materials and products.

B. Shop Drawings: Submit scaled layout drawings as required by Division-23 Section, “Basic HVAC Requirements”.

C. Record Drawings: At project closeout, submit record drawings of installed hydronic piping and piping products.

D. Maintenance Data: Submit maintenance data and parts lists for hydronic piping materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ASME B31.9 Code for Building Services Piping where applicable, base pressure rating on hydronic piping systems maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in hydronic piping systems. Where more than one type of materials or products is indicated, selection is Installer's option.

2.2 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-23 section "Identification for HVAC Piping and Equipment".

2.3 BASIC PIPES AND PIPE FITTINGS

A. General: Provide pipes and pipe fittings complying with Division-23 section "Pipe, Tube and Fittings for HVAC Systems", in accordance with the following listing:

B. Hydronic Piping:

1. Tube Size 2" (50 mm) and Smaller: Copper tube; Type L, hard drawn temper; wrought-copper fittings with solder-joints.
2. Pipe Size 2-1/2" (65 mm) and Larger: Black steel pipe; Schedule 40; wrought-steel buttwelding fittings with welded joints.

2.4 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division-23 section "Piping Specialties for HVAC Systems", in accordance with the following listing:

1. Pipe escutcheons
2. Pipeline strainers
3. Dielectric fittings
4. Drip pans
5. Sleeves
6. Sleeve seals

2.5 BASIC HANGERS AND SUPPORTS

A. General: Provide hangers and supports complying with Division-23 section "Hangers and Supports for HVAC Piping and Equipment", in accordance with the following listing:

1. Adjustable steel clevises, adjustable pipe saddle supports, single pipe rolls, and adjustable roller hangers, for horizontal piping hangers and supports.

2. Two-bolt riser clamps, for vertical-piping clamps.
3. Steel turnbuckles, for hanger-rod attachments.
4. Concrete inserts, C-clamps, malleable beam clamps, and steel brackets, for building attachments.
5. Protection saddles, for saddles and shields.

2.6 BASIC VALVES

A. General: Provide valves complying with Division-23 section "Valves for HVAC Piping", in accordance with the following listing:

1. Sectional Valves:

   a. 2" (50 mm) and Smaller: Ball valves.
   b. 2-1/2" (65 mm) and Larger: Butterfly valves.

2. Shutoff Valves:

   a. 2" (50 mm) and Smaller: Ball valves.
   b. 2-1/2" (65 mm) and Larger: Butterfly valves.

3. Balancing Valves:

   a. Combination shut-off/balance valve with venturi type flow meter fitting with integral readout ports and memory stop. Provide ball valve for 2” (50 mm) and smaller, butterfly valve for 2-1/2" (65 mm) and larger.
   b. See Division-23 section “Hydronic Specialties” for balance valve specification.

4. Drain Valves:

   a. 2" (50 mm) and Smaller: Ball valves.

5. Check Valves:

   a. All sizes: Swing check valves.

2.7 BASIC EXPANSION COMPENSATION

A. General: Provide expansion compensation products complying with Division-23 section "Expansion Compensation for HVAC Piping".

2.8 BASIC METERS AND GAUGES

A. General: Provide meters and gauges complying with Division-23 section "Meters and Gauges for HVAC Piping".

2.9 BASIC VIBRATION CONTROL

A. General: Provide vibration control products complying with Division-23 section "Vibration Isolation for HVAC Piping and Equipment".

PART 3 - EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which hydronic piping systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division-23 section "Identification for HVAC Piping and Equipment".

3.3 INSTALLATION OF HYDRONIC PIPING

A. General: Install hydronic piping in accordance with Division-23 section "Pipe, Tube and Fittings for HVAC Systems".

B. Install eccentric reducers where pipe is reduced in size in direction of flow, with tops of both pipes and reducer flush.

C. Connect branch-feed piping to mains at horizontal center line of mains, connect run-out piping to branches at horizontal center line of branches.

D. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Division-23 section "Piping Specialties for HVAC Systems".

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with Division-23 section "Hangers and Supports for HVAC Piping and Equipment".

3.6 INSTALLATION OF VALVES

A. Install valves in accordance with Division-23 section "Valves for HVAC Piping".

B. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two (2) or more hydronic terminals or equipment connections, and elsewhere as indicated.

C. Shutoff Valves: Install on inlet and outlet of each mechanical equipment item, control valves, strainers and elsewhere as indicated.

D. Balancing Valves: Install on outlet of each hydronic terminal, and elsewhere as indicated.

E. Drain Valves: Install on each mechanical equipment item and locate to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain hydronic piping system.

3.7 INSTALLATION OF EXPANSION COMPENSATION PRODUCTS

A. Install expansion compensation products in accordance with Division-23 section "Expansion Compensation for HVAC Piping".

3.8 INSTALLATION OF METERS AND GAUGES

A. Install meters and gauges in accordance with Division-23 section "Meters and Gauges for HVAC Piping".

3.9 EQUIPMENT CONNECTIONS

A. General: Connect hydronic piping system to mechanical equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated. Install shutoff valve and union/flange connection on supply and return, and drain valve on drain connection.

B. Hydronic Terminals: Install hydronic terminals with hydronic terminal valve and union on inlet and outlet. Install manual air vent valve on element in accordance with manufacturer's instructions. Locate valves and balancing cocks behind valve access doors for ease of maintenance. Where indicated, install automatic temperature control valve with unions between valve and element on supply line.

3.10 FIELD QUALITY CONTROL

A. Piping Tests: Test hydronic piping in accordance with testing requirements of Division-23 section "Testing, Adjusting and Balancing."

3.11 CLEANING

A. Cleaning, Flushing, and Inspecting: Clean, flush, and inspect hydronic piping systems in accordance with requirements of Division-23 section "Pipe, Tube and Fittings for HVAC Systems".

END OF SECTION 23 21 13

SECTION 23 21 15

HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of hydronic specialties required by this section is indicated on drawings and schedules, and by requirements of this section and all other Division-23 sections.

B. Types of hydronic specialties specified in this section include the following:

1. Balancing Valves
2. Air Vents
3. Air Separators
4. Expansion Tanks
5. Pump Suction Diffusers
6. Multi-purpose Valves
7. Bypass Feeders
8. Liquid Flow Switches
9. Water Relief Valves
10. Pressure Reducing Valves
11. Chilled Water Buffer Tanks

1.2 QUALITY ASSURANCE

A. Hydronic Specialty Types: Provide hydronic specialties of same type by same manufacturer.

B. Codes and Standards:

1. ASME Compliance: Manufacture and install hydronic specialties in accordance with ASME B31.9 "Building Services Piping".
2. UL and NEMA Compliance: Provide electrical components of hydronic specialties which are listed and labeled by UL, and comply with NEMA standards.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of hydronic specialty. Include pressure drop curve or chart for each type and size of hydronic specialty. Submit schedule indicating manufacturer's figure number, size, location, rated capacities, and features for each required hydronic specialty.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weights, required clearances, and method of assembly of components.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of hydronic specialty. Include this data, product data, and shop drawings in Maintenance Manual.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following (unless otherwise noted):

1. Bell and Gosset
2. Taco
3. Amtrol
4. Flow Design, Inc.

2.2 HYDRONIC SPECIALTIES

A. General: Provide factory-fabricated hydronic specialties recommended for use in service indicated. Provide hydronic specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option, but more than one type cannot be used on project.

2.3 BALANCING VALVES

A. General:

1. Manual balancing devices shall be venturi type as defined by ASHRAE. Devices shall have a precision machined throat and have a stated catalog accuracy of 3% full scale and have an actual accuracy of $\pm$5% of actual reading down to 10 in. w.c. pressure differential across the metering device. The induced differential reading (flow signal) shall be greater than two feet water column at the design flow with the valve in the wide open position. The permanent pressure loss at design flow shall not exceed two feet of water in the wide open position. The valves shall have differential readout ports fitted with check valve and protective cap, and are to have a memory stop to allow complete shut-off and return to set position without losing the setpoint.

B. Construction:

1. Valves 2” and Smaller: Brass ball valve, blowout proof stem, virgin Teflon seats, brass stems, stem seals and steel handles.
2. Valves 2-1/2” and Larger: Cast iron butterfly valve, full-lug type with EPDM seat, 416 stainless steel stem, bronze sleeve bearing and bronze disk. Valves 4” and smaller shall have manual lever. Valves 6” and larger shall have gear operated hand wheel.

C. Minimum Ratings:

1. Devices with sweat or NPT connections: 400 psig (2760 kPa) at 250°F (121°C).
2. Devices with flanged connections: 125 psig (862 kPa) at 250°F (121°C) suitable for the system for which it is installed.

D. Readout Meter Kit:

1. Provide a portable readout meter kit by the manufacturer of the balancing devices. The meter shall be permanently mounted in a durable case complete with two 10' (3 m) color coded hoses with shutoff valves at the end that connects to the balance valve so that water does not drain out between readings. Meter shall have a 6" (150 mm) diameter face and 1.75% full rated accuracy. Meter for the venturi type devices shall be provided with a removable transparent face indicating flow directly in GPM for each size device furnished. Meter shall have a three valve manifold for over-range protection.

E. Installation:

1. The straight pipe required to achieve 3% full scale accuracy shall be incorporated as an integral part of the venturi and valve assembly. No additional straight piping shall be required.
2. Install in accordance with the manufacturer's instructions.
3. Check connections after installation for leaks.

F. Balancing valves shall be Flow Set model UA (2" and smaller) or EF (2-1/2" and larger) as manufactured by Flow Design or Nutec.

2.4 AIR VENTS

A. Manual Air Vents: Provide manual vents designed to be operated manually with screwdriver or thumbscrew, 1/8" (3 mm) N.P.T. connection.

B. Automatic Air Vents: Provide automatic vents at all high points of the heating and chilled water systems. All valves shall be cast brass, rated for 150 psig design pressure and 270°F operating temperature. Units to include non-ferrous floats, stainless steel linkage and a Viton seal which closes against a brass spring operated seat. Units shall come complete with a 20 year limited warranty against defects in materials and workmanship, which should be given to owner after installation. Automatic air vents shall be Spirotop as manufactured by Spirotherm or equivalent.

2.5 AIR SEPARATORS

A. Furnish and install a combination full flow coalescing type high efficiency air eliminator / dirt and sediment separators on each of the heating and chilled water systems.

1. Units should be selected at the point of peak efficiency per the manufacturer's recommendations.
2. Air eliminators / separators shall be fabricated steel, rated for 150 psig working pressure with entering velocities not to exceed 4 feet per second

at specified GPM. Models specifically designed for high velocity systems may have an entering velocity of up to 10 feet per second.

3. Vessel diameter shall be a minimum of two times pipe size. Vessel height above the nozzle center-line shall be a minimum of 3 times pipe size for standard units and 4.5 times pipe size for high velocity units. Vessel shall extend below nozzle center-line the same distance for dirt separation.
4. Units shall include an internal tube bundle filling the entire vessel to suppress turbulence and provide high efficiency. The bundle shall consist of a copper core tube with continuous wound copper medium permanently affixed to the core. A separate copper medium is to be wound completely around and permanently affixed to each internal element.
5. Each eliminator shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral full port float actuated brass venting mechanism.
6. Units shall include a valved side tap to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill.
7. Unit shall include a blow down valve at bottom for removal of collected dirt and sediment.
8. Air eliminator function shall be capable of removing 100% of the free air, 100% of the entrained air, and up to 99.6% of the dissolved air in the system fluid during continuous circulation.
9. Dirt and sediment separator function shall be capable of removing 80% of particles 30 micron and larger within 100 passes. A properly selected strainer shall be installed upstream to collect large debris that may be left in the piping.
10. Provide removal head to facilitate internal element inspection or cleaning if required. Tube elements shall include tube sheets top and bottom and be manufactured as a bundle for ease or removal. Verify space required for bundle removal.

B. All units shall be Spirotherm or equivalent in size and construction.

2.6 EXPANSION TANKS

A. General: Provide expansion tanks of size and number as indicated. Construct tank of welded steel, constructed, tested, and stamped in accordance with Section VIII of ASME Boiler and Pressure Vessel Code (for a working pressure of 125 psi) (for a working pressure of 850 kPa). Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Provide heavy duty butyl rubber, removable bladder for inspection to separate air charge from system water, to maintain design expansion capacity. Provide pressure gage and air-charging fitting, and drain fitting.

2.7 PUMP SUCTION DIFFUSERS

A. General: Provide pump suction diffusers as indicated. Construct unit with angle pattern cast-iron body, threaded for 2" (50 mm) and smaller, flanged for 2-1/2" (65 mm) and larger, pressure rated for 175 psi (1200 kPa). Provide inlet vanes with length 2-1/2 times pump suction diameter or greater. Provide cylinder strainer with 3/16" (5 mm) diameter openings with total free area equal to or greater than 5 times cross sectional area of pump suction, designed to withstand

pressure differential equal to pump shutoff head. Provide disposal fine mesh strainer to fit over cylinder strainer. Where available, provide permanent magnet located in flow stream, removable for cleaning. Provide adjustable foot support designed to carry weight of suction piping. Provide blowdown tapping in bottom, gage tapping in side. Provide one extra mesh strainer for each pump suction diffuser.

2.8 MULTI-PURPOSE VALVES

A. General: Provide pump discharge multi-purpose valves as indicated. Provide nonslam check valve with spring-loaded disc and calibrated adjustment feature permitting regulation of pump discharge flow and shutoff. Design valves to permit repacking under full line pressure, and with bolt-on bonnet. Provide flanged cast-iron valve body, pressure rated for 175 psi (1200 kPa), maximum operating temperature of 240˚F (116˚C). Provide straight or angle pattern as indicated.

B. Multi-purpose valves shall have a pressure drop not to exceed 2 psi (14 kPa) at the scheduled pump capacity. Multi-purpose valve size shall not be more than one (1) pipe size less than full line size indicated.

2.9 BYPASS FEEDERS

A. General: Provide bypass feeders of 5 gallon (19 L) capacity or otherwise as indicated, constructed of cast iron or steel, for introducing chemicals in hydronic system. Provide funnel and valve on top for loading, drain valve in bottom, and recirculating valves on side. Construct for pressure rating of 125 psi (850 kPa).

2.10 LIQUID FLOW SWITCHES

A. General: Provide liquid flow switches as indicated to sense flow and non-flow. Construct of brass for all wetted parts, provide packless construction. Provide paddle with removable segments for pipe size and flow velocity. Provide vapor proof electrical compartment for switches mounted on cold hydronic piping systems. Furnish switches for 115 volt, 60 cycle, single phase, as manufactured by McDonnel and Miller, Inc., or equivalent.

2.11 WATER RELIEF VALVES

A. General: Provide water relief valves as indicated, of size and capacity as selected by Installer for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.

1. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, adjustable type, complying with ANSI Z21.22 Listing Requirements for temperature discharge capacity. Provide settings to protect the equipment, piping, etc. with the lowest maximum temperature and/or pressure reading.
2. Pressure Relief Valves: Bronze body, test lever, ASME rated, adjustable type. Provide pressure relief settings to protect the equipment, piping, etc. with the lowest maximum pressure rating for each system.

2.12 PRESSURE REDUCING VALVES

A. General: Provide pressure reducing valves as required, of size and capacity as selected by Installer to maintain operating pressure on system, and as manufactured by Watts or equivalent.

B. Construction: Cast iron or brass body, low inlet pressure check valve, inlet strainer removable without system shut-down, non-corrosive valve seat and stem, factory set at operating pressure.

2.13 CHILLED WATER BUFFER TANKS

A. Chilled Water buffer tank shall be manufactured by Cemline or Taco. Tank shall be ASME Code constructed and stamped in accordance with Section VIII of the ASME Code. Tank shall be registered with the National Board of Boiler and Pressure Vessel Inspectors and a certificate of shop inspection shall be furnished. ASME working pressure shall be 125 psi. Material of construction shall be Carbon Steel. Tank shall be furnished with an air vent, a 1/2" flexible, elastomeric thermal insulation black in color, and internal baffle to divert water flow. Tank shall be 36" diameter x 72" length, 300 Gallon Capacity with 4" flange inlet and outlet openings.

PART 3 - EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which hydronic specialties are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Owner's representative.

3.2 INSTALLATION OF HYDRONIC SPECIALTIES

A. Balancing Valves: Install venturi type balance valves at all hydronic coils and terminals including, but not limited to, fan coil units, unit ventilators, baseboard radiation, convectors, unit heaters, cabinet heaters, heating coils, cooling coils, etc. For four-pipe terminal units such as fan coil units and unit ventilators, provide balance valves at heating and cooling coil.

B. Air Vents:

1. Manual Air Vents: Install manual vents on each hydronic terminal at highest point, and on each hydronic piping drop in direction of flow for mains, branches, and runouts, and elsewhere as indicated. In addition, provide 1/2" ball valve with hose end connection, cap and chain at all high points within the piping system to accommodate manual venting of trapped air.
2. Automatic Air Vents: Install automatic vents at top of each hydronic riser and elsewhere as indicated. Install shutoff valve between riser and vent valve, pipe outlet to suitable plumbing drain, or as indicated.

C. In-line Air Separators: Install in-line air separators in pump suction lines. Connect inlet and outlet piping. Run piping to expansion tank with 1/4" per foot (6 mm per meter) (2%) upward slope towards tank. Install drain valve on units 2" (50 mm) and over.

D. Expansion Tanks: Install expansion tanks as indicated, in accordance with manufacturer's instructions. Vent and purge air from hydronic system, charge tank with proper air charge as recommended by manufacturer.

E. Pump Suction Diffusers: Install on pump suction inlet, adjust foot support to carry weight of suction piping. Install full size nipple and shutoff valve in blowdown connection. After cleaning and flushing hydronic piping system, but before balancing of hydronic piping system, remove disposable fine mesh strainer and install permanent strainer.

F. Bypass Feeders: Install bypass feeders on each closed hydronic system at pump discharge and elsewhere as indicated. Install in upright position with top of funnel not more than 48" (1200 mm) above floor. Pipe drain to nearest plumbing drain or as indicated.

G. Liquid Flow Switches: Install liquid flow switches on inlet to water chiller, inlet to water condenser, and elsewhere as indicated. Install in horizontal pipe with switch mounted in tee on top of pipe with minimum of 24" (600 mm) of straight pipe with no fittings both upstream and downstream of switch. Remove segments of paddle to fit pipe in accordance with manufacturer's instructions.

1. Wiring of liquid flow switches is specified in applicable Division-23 sections, and is included as work of this section.

H. Water Relief Valves: Install on hot water generators, and elsewhere as indicated. Pipe discharge to floor. Comply with ASME Boiler and Pressure Vessel Code.

I. Pressure Reducing Valves: Install for each system as required, and in accordance with manufacturer's installation instructions.

J. Multi-Purpose Valves: Provide multi-purpose valves at the discharge of each hydronic pump.

K. Low Point Drains: Provide a ball valve with hose end connection, cap and chain at all low points within the piping system to accommodated manual draining of water from the system. Drain valves shall be sized in accordance with the following criteria:

1. For pipes smaller than 3”, provide 3/4” ball valve.
2. For pipes 3” – 6”, provide 1” ball valve.
3. For pipes 8” and larger, provide 2” ball valve.

END OF SECTION 23 21 15

SECTION 23 21 23

HVAC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Extent of pump work required by this Section is indicated on the drawings and schedules, and by requirements of this Section and all other Division-23 sections.

B. Types of pumps specified in this Section include the following:

1. In-line circulator
2. Frame-mounted end-suction

1.2 QUALITY ASSURANCE

A. Codes and Standards: Provide pumps conforming to the following standards:

1. Hydraulic Institute (HI): Manufacture pumps in accordance with "Standards for Centrifugal Rotary, and Reciprocating Pumps."
2. UL and National Electrical Manufacturers Association (NEMA): Provide electric motors and components which are listed and labeled by UL and comply with NEMA standards. All motors shall be of the premium efficiency type with NEMA enclosures suitable for application.

B. Certification: Provide pumps whose performances, under specified operating conditions, are certified by the manufacturer.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's pump specifications, installation and start-up instructions, and current pump characteristic performance curves with selection points clearly indicated.

B. Shop Drawings: Submit manufacturer's shop drawings indicating dimensions, weight loadings, required clearances and methods of assembly of components.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Handle pumps carefully to prevent damage, denting and scoring. Do not install damaged pumps or components; replace with new.

B. Storage: Store pumps and components in a clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work shall be limited to the following:

1. Taco
2. Bell & Gossett
3. Armstrong

2.2 CENTRIFUGAL PUMPS: GENERAL

A. General: Provide factory tested pumps, thoroughly cleaned, and painted with machinery enamel prior to shipment. Type, size, and capacity of each pump is listed in the pump schedule. Provide pumps of the same type by the same manufacturer.

B. Non-Overloading: Motor brake horsepower shall not be exceeded at any point of the pump characteristic curve.

C. Working Pressure: Construct pumps for the working pressure in pounds per square inch specified or 175 psi (1200 kPa) if not indicated. Factory test at 1.5 times working pressure.

D. Pumps submitted utilizing the largest catalogued impeller diameter on the pump curve will not be acceptable. Provide pumps with an impeller size no larger than 95% of the maximum impeller diameter.

E. All bearings shall have an L10-200,000 hour rating.

F. Pumps shall have replaceable bronze casing wear ring.

2.3 IN-LINE CIRCULATORS

A. General: Provide in-line circulators where indicated and of capacities scheduled.

B. Type: Provide in-line circulators of the horizontal-mount, vertical split-case type, grease lubricated and designed for 125 psi (850 kPa) working pressure and 200°F (93°C) continuous water temperature.

C. Casings: Construct casings of cast iron with suction and discharge gauge tappings and flanged connections. Provide cast iron companion flanges.

D. Shafts: Provide hardened alloy steel shafts with copper shaft sleeve.

E. Bearings: Provide cartridge type bearing assembly.

F. Seals: Mechanical, with carbon steel ring and ni-resist seat.

G. Motors: Provide open, drip-proof motors conforming to NEMA MG 1 with grease lubricated bearings, resilient mounted construction and built-in thermal overload protection on single phase motors.

H. Couplings: Provide self-aligning, flexible couplings.

I. Impellers: Provide impellers of the enclosed type, constructed of bronze or stainless steel, hydraulically and dynamically balanced and keyed to the shafts.

2.4 FRAME-MOUNTED END SUCTION PUMPS

A. General: Provide frame-mounted end-suction pumps where indicated and of capacities and characteristics scheduled.

B. Type: Provide horizontally mounted pumps of the single stage, base mounted, vertical split case type with flexible couplings. Design for 175 psi (1200 kPa) working pressure.

C. Casings: Construct casings of cast iron with 125 psi (850 kPa) ANSI flanges and tappings for gauge and drain connections. Provide brass air vent cocks on pumps which are not self-venting.

D. Shafts: Provide SAE 1045 steel shafts with shaft sleeve and stainless steel shaft nuts.

E. Bearings: Provide regreasable ball bearings with 200,000 hour life, rated L10 and dust-sealed.

F. Mechanical Seals: Provide an internally flushed mechanical seal assembly of a carbon rotating assembly and a silicon carbide stationary assembly or a tungsten stationary assembly and a tungsten carbide rotating assembly.

G. Motors: Provide motors of the open, drip-proof, squirrel cage induction type with regreasable ball bearings, conforming to NEMA MG 1.

H. Impellers: Provide bronze impellers, enclosed type, hydraulically and dynamically balanced and keyed to the shaft. Secure with sleeve and impeller nuts.

I. Baseplates: Provide baseplates of structural steel with welded cross members, open grouting area, and drain rim around the entire pump with screwed drain connection. Paint to match pump finish. Provide area in base to allow for grouting after pumps have been piped.

J. Couplings: Provide flexible couplings, Woods Sureflex or equivalent, capable of absorbing torsional vibration. Equip with ANSI and OSHA compliant coupling guard.

K. Pump shall be designed to allow for true back pull-out access to the pump’s working components without disturbing the system piping.

2.5 MOTORS (TYPICAL FOR ALL PUMPS)

A. See Division-23 section, “Electrical Provisions for HVAC Equipment” for minimum motor efficiencies and other requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF PUMPS

A. General: Install pumps where indicated and in accordance with manufacturer's published installation instructions.

B. Support: Install floor mounted pumps on minimum of 4-inch (100 mm) high concrete base. Provide anchor bolts poured in place. Grout pump base level.

C. Vibration Bases: Refer to Division-23 section, "Vibration Isolation for HVAC Piping and Equipment" for support and mounting requirements of HVAC pumps.

3.2 ADJUSTING AND CLEANING

A. Alignment: Check alignment and, where necessary, realign shafts of motors and pumps within the recommended tolerances of the manufacturer. For all pumps alignment shall be performed with a dial indicator.

B. Start-Up: Lubricate pumps before start-up and start-up in accordance with manufacturer's instructions.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 23 21 23

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of refrigerant piping work is indicated by requirements of this section and all other Division-23 sections.

B. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of refrigerant piping products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Specialist with at least five (5) years of successful installation experience on projects with refrigerant piping work similar to that required for project.

C. Codes and Standards:

1. ASME Compliance: Fabricate and install refrigerant piping in accordance with ASME B31.5, "Refrigeration Piping", and extend applicable lower pressure limits to pressures below 15 psig (100 kPa).
2. UMC Compliance: Fabricate and install refrigerant piping in accordance with IAPMO "Uniform Mechanical Code".
3. ASHRAE Compliance: Fabricate and install refrigerant piping in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for refrigerant piping materials and products.

B. Brazing Certification: Certify brazing procedures, brazers and operators in accordance with ASME standards (ASME B31.5).

C. Shop Drawings: Submit scaled layout drawings of refrigerant pipe and fittings including, but not necessarily limited to, pipe and tube sizes, locations, elevations and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between piping and proximate equipment.

D. Maintenance Data: Submit maintenance data and parts lists for refrigerant piping materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ASME B31.5 Code for Refrigeration Piping where applicable, base pressure rating on refrigerant piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in refrigerant piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.2 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-23 sections "Basic HVAC Materials and Methods" and "Identification for HVAC Piping and Equipment", in accordance with the following listing:

1. Refrigerant Piping: Plastic pipe markers.

2.3 BASIC PIPES AND PIPE FITTINGS

A. General: Provide pipes and pipe fittings complying with Division-23 sections "Basic HVAC Materials and Methods" and "Pipe, Tube and Fittings for HVAC Systems", in accordance with the following listing:

1. Tube Size 3/4" (19 mm) and Smaller: Copper tube; Type ACR, soft annealed temper fittings; cast copper-alloy fittings for flared copper tubes; flared joints.
2. Tube Size 7/8" (22 mm) through 4-1/8" (105 mm): Copper tube; Type ACR, soft annealed temper; wrought-copper, solder-joint fittings; brazed joints.
3. Soldered Joints: Solder joints using silver-lead solder, ASTM B 32, Grade 96 TS.
4. Brazed Joints: Braze joints using American Welding Society (AWS) classification BCuP-5 for brazing filler metal.

2.4 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division-23 sections "Basic HVAC Materials and Methods" and "Piping Specialties for HVAC Systems", in accordance with the following listing:

1. Pipe escutcheons
2. Drip pans
3. Sleeves
4. Sleeve seals

2.5 BASIC HANGERS AND SUPPORTS

A. General: Provide hangers and supports complying with Division-23 sections "Basic HVAC Materials and Methods" and Hangers and Supports for HVAC Piping and Equipment", in accordance with the following listing:

1. Adjustable steel clevises, adjustable roller hangers, and adjustable pipe roll stands for horizontal piping hangers and supports.
2. Two-bolt riser clamps for vertical piping supports.
3. Concrete inserts, C-clamps, and steel brackets for building attachments.
4. Protection shields for insulated piping support in hangers.
5. Copper flashings for piping penetrations.

2.6 SPECIAL REFRIGERANT VALVES

A. General: Special valves required for refrigerant piping include the following types:

1. Globe and Check Valves:

a. Globe Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300°F (149°C) temperature rating, 500 psi (3450 kPa) working pressure.
b. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided brass piston and stainless steel spring, 250°F (121°C) temperature rating, 500 psi (3450 kPa) working pressure.

2. Solenoid Valves:

a. 2-Way Solenoid Valves: Forged brass, designed to conform to ARI 760, normally closed, teflon valve seat, NEMA 1 solenoid enclosure, 24 volt, 60 Hz., UL-listed, 1/2" (13 mm) conduit adapter, 250°F (121°C) temperature rating, 400 psi (2720 kPa) working pressure.

(1) Manual Operator: Provide manual operator to open valve.

2.7 REFRIGERANT SPECIALTIES

A. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel, screen, 100 mesh, UL-listed, 350 psi (2380 kPa) working pressure.

B. Moisture-Liquid Indicators: Forged brass, single port, removable polished optical glass, solder connections, UL-listed, 200°F (93°C) temperature rating, 500 psi (3450 kPa) working pressure.

C. Evaporator Pressure Regulators: Provide corrosion-resistant, spring loaded, stainless steel springs, pressure operated, evaporator pressure regulator, in size and working pressure indicated, with copper connections.

PART 3 - EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which refrigerant piping systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division-23 sections "Basic HVAC Materials and Methods" and "Identification for HVAC Piping and Equipment".

3.3 INSTALLATION OF REFRIGERANT PIPING

A. General: Install refrigerant piping in accordance with Division-23 sections "Basic HVAC Materials and Methods" and "Pipe, Tube and Fittings for HVAC Systems", and in compliance with equipment manufacturer's recommendations.

B. Install refrigerant piping with 1/4" per foot (6 mm per meter) (1%) downward slope in direction of oil return to compressor. Provide oil traps and double risers where indicated, and where required to provide oil return.

C. Clean refrigerant piping by swabbing with dry lintless (linen) cloth, followed by refrigerant oil soaked swab. Remove excess oil by swabbing with cloth soaked in high flash point petroleum solvent, squeezed dry.

D. Bleed dry nitrogen through refrigerant piping during brazing operations.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with requirements of Division-23 sections "Basic HVAC Materials and Methods" and "Piping Specialties for HVAC Systems".

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Install supports and anchors in accordance with requirements of Division-23 sections "Basic HVAC Materials and Methods" and "Hangers and Supports for HVAC Piping and Equipment".

3.6 INSTALLATION OF SPECIAL REFRIGERANT VALVES

A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions. Remove accessible internal parts before soldering or brazing, replace after joints are completed.

1. Solenoid Valves: Install in refrigerant piping as indicated with stem pointing upwards.

a. Wiring of solenoid valves is specified in applicable Division-26 sections, and is included as work of this section.

3.7 INSTALLATION OF REFRIGERANT ACCESSORIES

A. Refrigerant Strainers: Install in refrigerant lines as indicated, and in accessible location for service.

B. Moisture-Liquid Indicators: Install as indicated on refrigerant liquid lines, in accessible location.

C. Evaporator Pressure Regulators: Install in refrigerant suction lines or evaporator outlets as indicated. Adjust, if required, for proper evaporator pressure.

3.8 EQUIPMENT CONNECTIONS

A. General: Connect refrigerant piping to mechanical equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated.

3.9 FIELD QUALITY CONTROL

A. Refrigerant Piping Leak Test: Prior to initial operation, clean and test refrigerant piping in accordance with ASME B31.5, "Refrigeration Piping". Perform initial test with dry nitrogen, using soap solution to test all joints. Perform final test with 27" vacuum (7 kPa), and then 200 psi (1360 kPa) using halide torch. System must be entirely leak-free.

B. Repair or replace refrigerant piping as required to eliminate leaks, and retest as specified to demonstrate compliance.

3.10 DEHYDRATION AND CHARGING SYSTEM

A. Install core in filter dryer after leak test but before evacuation.

B. Evacuate refrigerant system with vacuum pump, until temperature of 35°F (2°C) is indicated on vacuum dehydration indicator.

C. During evacuation, apply heat to pockets, elbows, and low spots in piping.

D. Maintain vacuum on system for minimum of five (5) hours after closing valve between vacuum pump and system.

E. Break vacuum with refrigerant gas, allow pressure to build up to 2 psi (14 kPa).

F. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

3.11 ADJUSTING AND CLEANING

A. Cleaning and Inspecting: Clean and inspect refrigerant piping systems in accordance with requirements of Division-23 section "Pipe, Tube and Fittings for HVAC Systems".

END OF SECTION 23 23 00

SECTION 23 25 00

WATER TREATMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of water treatment is indicated by the requirements of this section.

B. Provide complete water treatment service for a period of two (2) years from date of start-up for the following systems (all systems are assumed to be in operation twelve (12) months per year):

1. Heating water systems
2. Chilled water systems

1.2 QUALITY ASSURANCE

A. Installer Qualifications: Work shall be performed by specialists with a minimum of five (5) years experience on similar work to that required for project.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for water treatment materials and products.

B. Record Drawings: At project closeout, submit record drawings of installed water treatment products.

C. Maintenance Data: Submit manufacturer's maintenance data for water treatment materials and products. Include this data, product data, shop drawings and record drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. Furnish and install chemical feeding equipment, as specified below, to introduce chemicals into each system only when the system is operating:

1. Closed Recirculating Systems – Chilled and Heating Water (Refer to Drawing E-2):

a. Five gallon (19 L) steel by-pass feeder with bag filter installed across circulating pump suction and discharge lines, with tank and piping insulated using the same thickness and type of insulation as provided for the piping system.

PART 3 - EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which water treatment materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 WATER TREATMENT SERVICES

A. Water treatment services shall be, but not limited to, the following services:

1. Analyze the available water supply for the following:

   a. pH
   b. Total alkalinity
   c. Chlorides
   d. Silica
   e. Hardness
   f. Total dissolved solids

   NOTE: If alkalinity exceeds 125 PPM or hardness exceeds 300 PPM, Contractor shall furnish and install an acid feed control system. This applies to open recirculating water systems only.

2. Make service visits once per month on closed recirculating systems to adjust feeding equipment, apply chemicals, obtain and analyze samples , in order to maintain conditions as specified below.
3. Obtain a signed work order after each visit and leave a report indicating which systems were serviced.
4. Maintain complete records of the treatment program for each system, such records to be made available upon request.
5. Instruct mechanical contractor in field on piping and wiring of chemical feeding equipment.
6. Furnish all necessary labor, chemicals, feeding equipment, piping, wiring and instrumentation required for the specified treatment.
7. Maintain the conditions in each system as indicated in the following table:

	Chilled Water Systems	Heating Water Systems
pH	8.0 to 10.5	8.0 to 10.5
Inhibitor for Scale and Corrosion	---	---
Cycles	---	---
Organic Growths	---	---
Corrosion Inhibitor	50 to 100 PPM (as Molybdate) or 500 to 1000 PPM Sodium Nitrite	100 to 150 PPM (as Molybdate) or 1000 to 1500 PPM Sodium Nitrite
Sulfite	---	---
Chloride as C1	---	---
Sulfate as SO_4	---	---
Hardness as $CaCO_3$	---	---

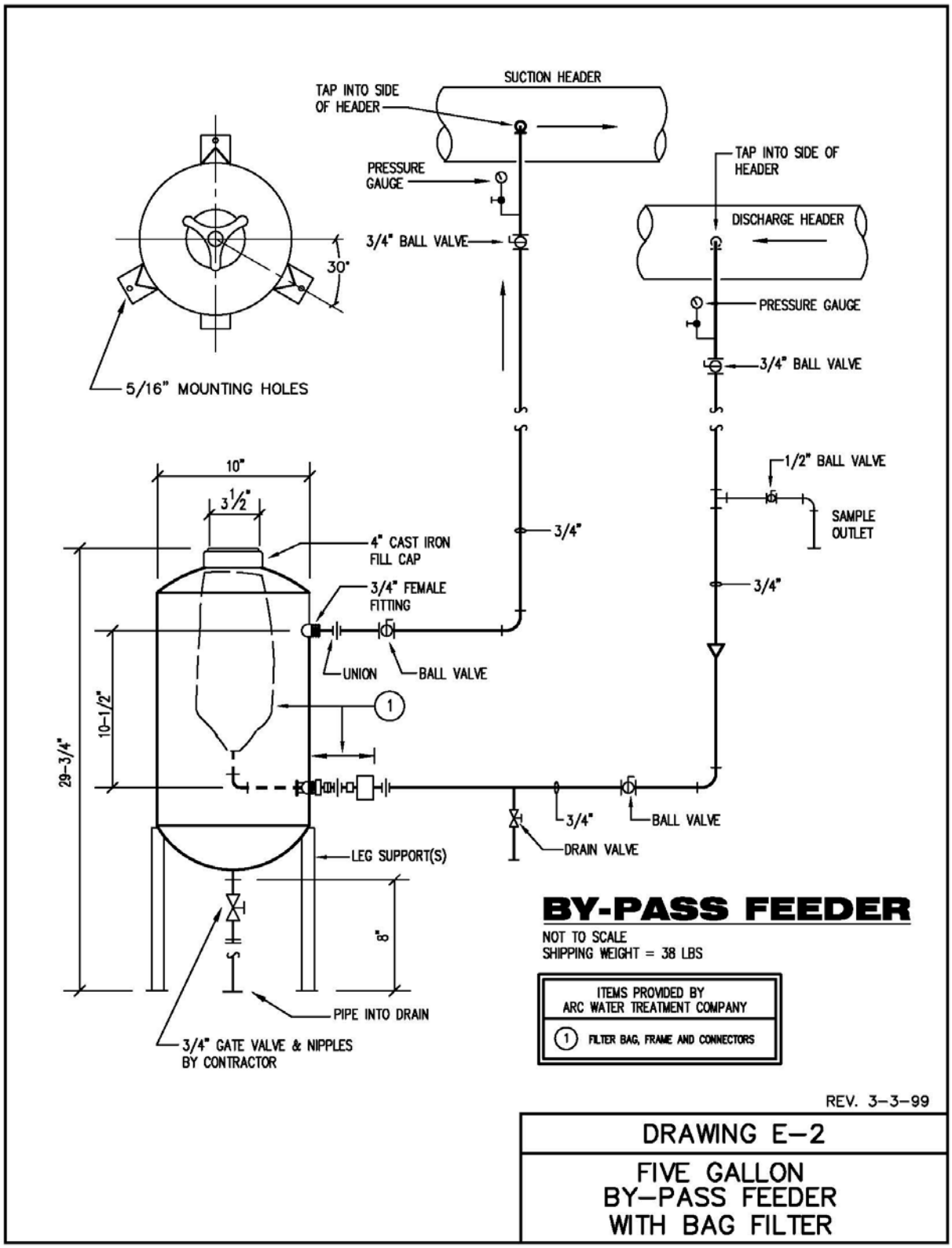
8. Legionella Test: Perform monthly tests, conducted in a certified lab, of the cooling tower water for Legionella Pneumophila. Submit reports stating bacteria count per millimeter and the results from the previous tests. Forward report to the customer.
9. Closed recirculating systems shall be filled and sufficient detergent and dispersant added to remove all dirt, oil and grease. System shall be circulated for at least forty-eight (48) hours after which a drain valve at the lowest point shall be opened and allowed to bleed while the system continues to circulate. The automatic make-up valve shall be checked to make sure it is operating. Bleeding shall continue until water runs clear and all detergent is removed. A sample of water shall be tested and if pH exceeds the pH of the make-up water, draining shall be resumed.

    a. Prior to adding cleaning chemical to the closed system, all air handling coils and fan coil units should be isolated by closing the inlet and outlet valves and opening the by-pass valves. This is done to prevent dirt and solids from lodging in the coils.
    b. After chemical cleaning is satisfactorily completed, open the inlet and outlet valves to each coil, close the by-pass valves and clean all strainers.

10. New boilers shall be boiled out with an alkaline type boiling out compound to remove grease, oil, millscale and other foreign matter. The compound should be used at the rate of 1-1/2 pounds per 20 boiler horsepower (.7 Kg per 15 kW boiler horsepower). After the boiling out period, the boiler shall be completely drained, flushed and refilled with fresh water.

11. After final testing for leaks, all new potable water lines shall be thoroughly flushed by plumbing contractor to remove foreign material. Before placing the systems in service, Contractor shall engage a qualified service organization, to sterilize the systems in accordance with the following procedure:

    a. Through a 3/4" (20 mm) hose connection in the main entering the building, pump in sufficient sodium hypochlorite to produce a free available chlorine residual of not less than 200 PPM. Plumbing contractor shall provide plumbing connections and power for pumping chlorine into the system.
    b. Proceed upstream from the point of chlorine application opening all faucets and taps until chlorine is detected. Close faucets and taps when chlorine is evident.
    c. When chlorinated water has been brought to every faucet and tap with a minimum concentration of 200 PPM chlorine, retain this water in the system for three hours.
       CAUTION: Over-concentration of chlorine and more than three (3) hours of retention may result in damage to piping system.
    d. At the end of the retention period, no less than 100 PPM of chlorine shall be present at the extreme end of the system.
    e. Proceed to open all faucets and taps and thoroughly flush all new lines until the chlorine residual in the water is less than 1.0 PPM.
    f. Obtain representative water samples from the system for analysis by a recognized bacteriological laboratory.
    g. If the sample tested for coliform organisms is negative, a letter and laboratory reports shall be submitted by the service organization to the Contractor, certifying successful completion of the sterilization.
    h. If any samples tested indicate the presence of coliform organisms, the entire sterilization procedure shall be repeated.



END OF SECTION 23 25 00

SECTION 23 31 13

LOW PRESSURE DUCTWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of low pressure ductwork is indicated on drawings and in schedules, and by requirements of this section and all other Division-23 sections. Low pressure duct systems shall be defined as those duct systems which have an external static pressure of less than two-inches (2") water column (w.c.) (500 Pa). See schedules on drawings for external static pressure information.

B. Types of low pressure ductwork which may be required for this project include the following:

1. Return air ductwork
2. Outdoor air intake ductwork
3. Exhaust ductwork
4. Relief ductwork
5. Kitchen exhaust ductwork
6. Supply air ductwork (downstream of air terminals only)
7. Air transfer ductwork
8. Make-up air ductwork

1.2 QUALITY ASSURANCE

A. Installer: A firm with a minimum of five (5) years of successful installation experience on projects with low pressure ductwork systems similar to that required for project.

B. SMACNA Standards: Comply with latest edition of SMACNA Standards for fabrication, storage and installation of low pressure ductwork. In addition, all new ductwork shall comply with SMACNA's "Duct Cleanliness for New Construction Guidelines." The "Duct Cleanliness Level" for all ductwork shall meet the requirements of the "Advanced Level."

C. ASHRAE Standards: Comply with ASHRAE Standards for fabrication and installation of low pressure ductwork.

D. NFPA Compliance: Comply with ANSI/NFPA 90A "Standard for the Installation of Air-Conditioning and Ventilating Systems" and ANSI/NFPA 90B "Standard for the Installation of Warm Air Heating and Air-Conditioning Systems."

E. Field Reference Manual: Have available at project field office, copy of SMACNA Standards - latest edition.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications on manufactured products used for work of this section.

B. Shop Drawings: Submit dimensioned layouts of ductwork showing both the accurately scaled ductwork and its relation to space enclosure as required by Division-23 Section, “Basic HVAC Requirements”. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.

C. Record Drawings: At project closeout, submit record drawings of installed ductwork, duct accessories, and outlets and inlets.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect shop-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. All ductwork shall be shipped to the site with covered ends. The ductwork shall be covered with 3-mil (minimum) shrink wrap, with a minimum 2-inch overlap on all sides, to provide a water-tight seal at each opening. The covered ends shall remain intact until installation.

C. Store ductwork, accessories and purchased products inside and protect from weather.

D. Ductwork fittings and accessories stored on site for installation shall be covered with protective tarps and elevated a minimum of four inches until installed.

E. Provide periodic (weekly) photographs of the jobsite storage to document that the ductwork is stored in accordance with the criteria outlined in this specification section.

F. Lined ductwork not stored in accordance with the above criteria shall be replaced in its entirety. Unlined ductwork not stored in accordance with the above criteria shall be cleaned and inspected by the Owner’s representative prior to installation. Contractor shall clean unlined ductwork to the satisfaction of the Owner, or replace at the Owner’s discretion.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting. Provide interior lining or double wall duct as indicated on the drawings and/or these specifications.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ANSI/ASTM A 527, lockforming quality, with ANSI/ASTM A 525, G90 zinc coating; mill phosphatized for exposed locations.

C. Stainless Steel Sheet: Where indicated (S/S), provide stainless steel complying with ANSI/ASTM A 167; AISI Type 302/304/316 with No. 4 directional polish where exposed to view in occupied spaces. Protect finished surfaces with mill-

applied adhesive protective paper, maintained through fabrication and installation.

D. Aluminum Sheet: Where indicated (Al-), provide aluminum complying with ANSI/ASTM B 209, Alloy 3003, Temper H14.

2.2 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Provide miscellaneous materials and products of types and sizes indicated. Provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Duct Liner: Minimum one inch (25 mm) thick (unless otherwise noted) fiberglass, minimum R-value of 4.2 (k-value 0.24 or better), complying with ASTM C 1071, ASTM G 21, ASTM G 22, NFPA 90A, NFPA 90B and UL 181. Duct lining shall contain an EPA registered antimicrobial agent which resists the growth of bacteria and fungi as proven by tests in accordance with ASTM G21 and G22. Liner noise reduction coefficient (NRC) shall be 0.70 or better. Surface of liner shall have water repellent properties. Duct liner shall be Johns Manville Linacoustic RC or equivalent by Certainteed, Knauf or Owens Corning.

C. Duct Liner Adhesive: Comply with Adhesive and Sealant Council, Inc. (ASC) and ASTM C916.

D. Duct Liner Fasteners: Comply with SMACNA Standards. Fasteners shall not compress liner by more than 1/8".

E. Duct Sealant: Non-hardening, non-migrating, oil based mastic or liquid elastic sealant (type applicable for fabrication and installation) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. Sealant shall be solvent (oil) based, water based or silicone based as follows:

1. Solvent (oil) based sealant shall be used for indoor applications on all new construction installations. In addition, for indoor renovation projects, solvent (oil) based sealant shall be included in the contractor’s bid and utilized wherever the sealant odor is not objectionable to the owner. Contractor shall coordinate with the owner’s representative prior to the duct installation.
2. Water based sealant shall be utilized for indoor renovation applications where the odor from solvent (oil) based sealant is objectionable to the owner. Contractor shall coordinate with the owner’s representative prior to the duct installation.
3. Silicone based solvent shall be utilized for all outdoor duct installation applications.
4. Regardless of duct sealant type, maximum duct leakage requirements outlined in these Division-23 specifications shall be maintained.

F. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.

G. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

1. Except where space is indicated as "High Humidity" area, interior support materials of not less than 1/4" (6 mm) diameter or 3/16" (4.8 mm) thickness may be plain (not galvanized).
2. For exposed stainless steel ductwork, provide matching stainless steel support materials.
3. For aluminum ductwork, provide aluminum support materials except where materials are electrolytically separated from ductwork.

2.3 FABRICATION

A. Shop fabricate ductwork in 4 (1200 mm), 8 (2400 mm), 10 (3000 mm) or 12-foot (3600 mm) lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

B. Shop fabricate ductwork of gauges and reinforcement complying with SMACNA Standards - latest edition.

C. Shop fabricate ductwork of gauges and reinforcement complying with ASHRAE Standards.

D. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to one and one-half times the associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

E. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-23 section "Ductwork Accessories" for accessory requirements.

F. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.

G. Low pressure rectangular ductwork, fittings, etc., shall be constructed, installed and supported in accordance with current SMACNA Standards of gauges not less than the following:

Maximum Side	Minimum Gauge
Up to 12" (Up to 300 mm)	26 (.5 mm)
13" to 30" (325 mm to 750 mm)	24 (.7 mm)
31" to 60" (775 mm to 1500 mm)	22 (.8 mm)
61" to 84" (1525 mm to 2100 mm)	20 (1.0 mm)
Over 84" (Over 2100 mm)	18 (1.3 mm)

H. All factory or shop fabricated ductwork shall be constructed as required to meet the testing requirements indicated in this section and Division-23 section "Testing, Adjusting and Balancing."

2.4 SPIRAL AND INSULATED DOUBLE-WALL OVAL OR ROUND DUCTWORK

A. Spiral insulated double-wall oval or round duct shall have locked seams equivalent to United McGill "Uni-Seal," so made as to eliminate any leakage under the pressures for which this system has been designed. Spiral duct shall be manufactured of galvanized steel meeting ASTM A-527 by the spiral lockseam method and in the minimum gauges listed:

Diameter	Minimum Gauge
3" thru 26" (75 mm thru 650 mm)	26 (.5 mm)
28" thru 36" (700 mm thru 900 mm)	24 (.7 mm)
38" thru 50” (950 mm thru 1250)	22 (0.8 mm)
52" thru 60” (1300 mm thru 1500)	20 (1.8 mm)
62” and larger (1550 mm and larger)	18 (1.2 mm)

1. All fittings are to have continuous welds along all seams. All divided flow fittings are to be manufactured as separate fittings, not as tap collars welded into spiral duct sections. Fittings and couplings shall be of the following minimum gauges:

Diameter	Minimum Gauge
3" thru 26" (75 mm thru 650 mm)	24 (.7 mm)
28" thru 36" (675 mm thru 900 mm)	22 (1.0 mm)
38" thru 50” (950 mm thru 1250)	20 (1.0 mm)
52" thru 60” (1300 mm thru 1500)	18 (1.2 mm)
62” and larger (1550 mm and larger)	16 (1.4 mm)

2. Branch fittings supplying linear bar diffusers shall be "lo-loss" conical type saddle taps.
3. All 90 degree tees and 45 degree laterals, either full size or reducing, shall be conical pattern for 90 degree and straight pattern for 45 degree laterals, produced by machine or press forming. The entrance shall be free of weld build-up, burrs or irregularities. Provide tangential tees where required.
4. Elbows in diameters 3" (75 mm) through 12" (300 mm) shall be two section die-stamped elbows. All other elbows shall be gored construction with all seams continuous-welded. Elbows shall be fabricated to a centerline radius of 1.5 times the cross section diameter. All elbows not die-stamped shall be fabricated according to the following schedule:

Elbow Angle	Number of Gores
Less than 45˚	2
46˚ thru 60˚	2
Over 61˚	3

5. The reduction of divided flow fittings shall be conical spun section in the thirty-six reductions in sizes 4" (100 mm) through 22" (550 mm).

6. Spun bellmouth connections shall be used at each round take-off from the high pressure plenum.
7. Offset fittings shall be constructed so that length of offset is not less than two (2) duct diameters.
8. Galvanized areas that have been damaged by welding shall be coated with corrosion resistant aluminum paint, minimum two (2) coats.
9. Supports and sealants shall conform with applicable portions of SMACNA.
10. Flexible ductwork shall be as previously specified for low pressure duct systems.
11. Acceptable manufacturers for spiral and double-wall oval and round ductwork: United McGill, Semco and Eastern Sheet Metal.

2.5 FLEXIBLE DUCTWORK

A. General: Provide insulated flexible ductwork where indicated on drawings, as manufactured by Flex Master Type 6B, or equivalent. Flexible ductwork shall be in compliance with UL-181 Class 1 Air Duct, fabricated with an acoustically transparent nylon inner fabric.

1. Liner: Nylon fabric, mechanically locked without adhesives.
2. Helix: Corrosion resistant galvanized steel; formed and mechanically locked to fabric.
3. Vapor Barrier: Black fire retardant, polyethylene.
4. Insulation: 1” thick. R-value of 6.0.
5. Pressure Rating: 6” wg positive.

B. Sound Attenuation: Flexible ductwork shall have sound attenuating capabilities as indicated below for nominal three feet of straight duct:

Duct Diameter	Insertion Loss (db)						
	63	125	250	500	1000	2000	4000
6	3	9	10	11	12	12	12
8	3	9	9	10	10	12	12
10	3	9	9	9	10	11	10
12	3	9	8	8	9	11	8

2.6 KITCHEN EXHAUST DUCTS

A. General: Fabricate kitchen exhaust ducts and supports, used for smoke and vapor removal from cooking operations, of 18 gauge (1.3 mm) minimum stainless steel. For duct construction, comply with SMACNA "Low Pressure Duct Standards - Latest Edition", and ANSI/NFPA 96 "Ventilation Control and Fire Protection of Commercial Cooking Operations."

2.7 FRESH AIR INTAKE PLENUMS

A. Fresh air intake plenums shall be double wall construction (minimum 18 gauge exterior wall, 20 gauge interior wall) with 2" (50 mm) thick, three pound density insulation.

2.8 OUTDOOR DUCTWORK

A. All outdoor ductwork shall be double walled duct with fiberglass liner (3” for supply, 2” for return). In addition, duct shall be provided with an outdoor duct insulation system (see Division-23 section “HVAC Insulation” of these specifications) suitable for outdoor applications and U/V exposure. Provide aluminum saddles between duct insulation and duct supports to protect insulation. Contractor shall fasten ductwork to equipment supports as required to withstand windloading. Design of fastening system to withstand windloading shall be approved by a registered structural engineer.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK

A. General: Assemble, install and support ductwork in accordance with recognized industry practices which will achieve air tight (1% leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 1/8" (3 mm) misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling.

B. Seal ductwork, after installation, to SMACNA Standard Seal Class "A".

C. Install concrete inserts as required, for support of ductwork in coordination with formwork, as required to avoid delays in work.

D. Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.

E. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" (13 mm) where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" (25 mm) clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

F. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and their electrical equipment spaces and enclosures.

G. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gauge as duct. Overlap opening on four (4) sides by at least 1-1/2" (40 mm).

H. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

I. Support ductwork in manner complying with SMACNA Standards - latest edition of hangers and supports section.

J. Unless indicated otherwise, all stainless steel ductwork shall be welded.

K. Where vapors will be exhausted (dishwasher, cart wash, tunnel wash, canopy hood over sterilizers, etc.), ductwork shall be sloped back toward the source of moisture.

L. All exposed ductwork shall be primed and painted with paint appropriate for sheet metal surfaces. See architectural section "Painting".

M. Provide gasketed duct access doors as required to provide maintainable access to the upstream side of coils, humidifiers, etc.

3.2 INSTALLATION OF LINED DUCTWORK

A. Provide lined ductwork at the following locations, and as otherwise indicated:

1. All supply, return, relief air ductwork within the Mechanical Room and the first twenty-five feet (7500 mm) of ductwork upstream and downstream of air handling equipment, including return air fans, with the exception of outdoor air intake ductwork.
2. Supply air ductwork downstream of air terminals.
3. All air transfer ductwork, unless otherwise indicated.

B. Dimensions on drawings indicate inside clear dimensions.

C. Fiberglass liner exposed to the air stream shall not be utilized for outdoor air intake ductwork.

D. Where ductwork is exposed to view in occupied areas, rectangular ductwork shall be lined and round ductwork shall be double wall duct with internal lining, unless otherwise noted.

3.3 INSTALLATION OF FLEXIBLE DUCTWORK

A. Where indicated, provide factory insulated flexible ductwork between low pressure supply ductwork and round inlet ceiling diffusers. Provide side take-off fitting with damper (Flexmaster USA, model STOD or equivalent) between the flexible duct and the low pressure supply ductwork. Extend rigid sheet metal ductwork between the fitting and the flexible ductwork as required. The maximum length of flexible duct shall be 3’- 0” (915 mm).

B. Connections to round neck diffusers shall include a rigid 45 degree sheet metal elbow at the diffuser inlet.

3.4 INSTALLATION OF KITCHEN EXHAUST DUCTS

A. General: Fabricate joints and seams with continuous welds for watertight construction. Provide for thermal expansion of ductwork through 2000˚F (1093˚C) temperature range. Install without dips or traps which may collect residues, except where traps have continuous or automatic residue removal. Provide access openings at each change in direction, located on sides of duct 1-1/2" (40 mm) minimum from bottom, and fitted with greasetight covers of same material as duct. Installation of ductwork and associated fan(s) shall comply with NFPA 96 "Ventilation Control and Fire Protection of Commercial Cooking Operations," including duct clearances from combustible/non-combustible building materials.

3.5 CLEANING AND PROTECTION

A. Prior to installation, thoroughly clean ductwork internally of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless steel ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, install sheet metal temporary closures which will prevent entrance of dust and debris until the time all connections are to be completed.

D. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

3.6 DUCT TESTING

A. Prior to the balancing of systems by the AABC certified balancing contractor, all low pressure ductwork shall be tested by the mechanical contractor for duct leakage. Duct leakage shall not exceed 1% of design cfm for a duration of ten (10) minutes. Test pressures shall be not less than the following:

Low Pressure Ductwork: 25% above system operating pressure, but not less than 2" w.c. (500 Pa)

Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet the above testing requirements.

B. The balance contractor shall witness and certify all duct pressure tests.

3.7 BALANCING

A. Refer to Division-23 section "Testing, Adjusting and Balancing" for air distribution balancing of low pressure ductwork; not work of this section.

END OF SECTION 23 31 13

SECTION 23 31 14

HIGH PRESSURE DUCTWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of high pressure ductwork is indicated on drawings and in schedules and by requirements of this section and all other Division-23 sections. High pressure duct systems shall be defined as those duct systems which have an external static pressure of two-inches (2") water column (w.c.) (500 Pa) or greater. In addition, all ductwork upstream of terminal units shall be classified as high pressure. See schedules on drawings for external static pressure information.

B. Types of high pressure ductwork which may be required for this project include the following:

1. Supply air ductwork (upstream of terminal units i.e. from air handling unit to air terminals).
2. Return and exhaust sir ductwork (upstream of terminal units of control dampers to return or exhaust fan).

1.2 QUALITY ASSURANCE

A. Installer: Work shall be performed by a firm with a minimum of five (5) years of successful experience on projects with high pressure ductwork systems similar to that required for project.

B. SMACNA Standards: Comply with latest edition of SMACNA Standards for fabrication, storage, and installation of high pressure ductwork. In addition, all new ductwork shall comply with SMACNA's "Duct Cleanliness for New Construction Guidelines." The "Duct Cleanliness Level" for all ductwork shall meet the requirements of the "Advanced Level."

C. ASHRAE Standards: Comply with ASHRAE Standards for fabrication and installation of high pressure ductwork.

D. NFPA Compliance: Comply with ANSI/NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and ANSI/NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

E. Field Reference Manual: Have available at project field office copy of SMACNA Standards - latest edition.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications on manufactured products and factory-fabricated ductwork used for work of this section.

B. Shop Drawings: Submit dimensioned layouts of ductwork showing both the accurately scaled ductwork and its relation to space enclosure as required by Division-23 Section, “Basic HVAC Requirements”. Show modifications of indicated requirements made to conform to local shop practice and how those modifications ensure that free area materials and rigidity are not reduced.

C. Record Drawings: At project closeout, submit record drawings of installed ductwork, duct accessories, and outlets and inlets.

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect shop-fabricated and factory-fabricated ductwork accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. All ductwork shall be shipped to the site with covered ends. The ductwork shall be covered with 3-mil (minimum) shrink wrap, with a minimum 2-inch overlap on all sides, to provide a water-tight seal at each opening. The covered ends shall remain intact until installation.

C. Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

D. Ductwork fittings and accessories stored on site for installation shall be covered with protective tarps and elevated a minimum of four inches until installed.

E. Provide periodic (weekly) photographs of the jobsite storage to document that the ductwork is stored in accordance with the criteria outlined in this specification section.

F. Lined ductwork not stored in accordance with the above criteria shall be replaced in its entirety. Unlined ductwork not stored in accordance with the above criteria shall be cleaned and inspected by the Owner’s representative prior to installation. Contractor shall clean unlined ductwork to the satisfaction of the Owner, or replace at the Owner’s discretion.

PART 2 – PRODUCTS

2.1 DUCTWORK MATERIALS

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting. Provide interior lining or double wall duct as indicated on the drawings and/or these specifications.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ANSI/ASTM A 527, lockforming quality with ANSI/ASTM A 525, G90 zinc coating; mill phosphatized for exposed locations.

C. Stainless Steel Sheet: Where indicated (S/S), provide stainless steel complying with ANSI/ASTM A 167; AISI Type 302/304/316 with No. 4 directional polish where exposed to view in occupied spaces. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

2.2 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Provide miscellaneous materials and products of types and sizes indicated. Provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Duct Liner: Minimum one inch (25 mm) thick (unless otherwise noted) fiberglass, minimum R-value of 4.2 (K-value 0.24 or better), complying with ASTM C 1071, ASTM G 21, ASTM G 22, NFPA 90A, NFPA 90B and UL 181. Duct lining shall contain an EPA registered antimicrobial agent which resists the growth of bacteria and fungi as proven by tests in accordance with ASTM G21 and G22. Liner noise reduction coefficient (NRC) shall be 0.70 or better. Surface of liner shall have water repellent properties. Duct liner shall be Johns Manville Linacoustic RC or equivalent by Certainteed, Knauf or Owens Corning.

C. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15˚ change of direction per section, unless specifically detailed otherwise. Use 45˚ straight type laterals and 45˚ elbows for branch take-off connections. Where 90˚ branches are indicated, provide conical type tees.

D. Duct Sealant: Non-hardening, non-migrating, oil based mastic or liquid elastic sealant (type applicable for fabrication and installation) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. Sealant shall be solvent (oil) based, water based or silicone based as follows:

1. Solvent (oil) based sealant shall be used for indoor applications on all new construction installations. In addition, for indoor renovation projects, solvent (oil) based sealant shall be included in the contractor's bid and utilized wherever the sealant odor is not objectionable to the owner. Contractor shall coordinate with the owner's representative prior to the duct installation.
2. Water based sealant shall be utilized for indoor renovation applications where the odor from solvent (oil) based sealant is objectionable to the owner. Contractor shall coordinate with the owner's representative prior to the duct installation.
3. Silicone based solvent shall be utilized for all outdoor duct installation applications.
4. Regardless of duct sealant type, maximum duct leakage requirements outlined in these Division-23 specifications shall be maintained.

E. Duct Cement: Non-hardening, migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components or longitudinal seams in ductwork.

F. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

1. Except where space is indicated as "High-Humidity" area, interior support materials of not less than 1/4" (6 mm) diameter or 3/16" (4.8 mm) thickness may be plain (not galvanized).
2. For exposed stainless steel ductwork, provide matching stainless steel support materials.

2.3 FABRICATION

A. Shop fabricate rectangular ductwork in 4 (1200 mm), 8 (2400 mm), 10 (3000 mm) or 12-foot (3600 mm) lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

B. Shop fabricate ductwork of gauges and reinforcement complying with SMACNA Standards - latest edition.

C. Shop fabricate ductwork of gauges and reinforcement complying with ASHRAE Standards.

D. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings, except as otherwise indicated. Fabricate elbows with center-line radius equal to one and one-half times the associated duct width. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.

E. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-23 section "Ductwork Accessories" for accessory requirements.

F. All factory or shop fabricated ductwork shall be constructed as required to meet the testing requirements of this section and Division-23 section "Testing, Adjusting and Balancing."

2.4 FACTORY-FABRICATED DUCTWORK

A. General: Provide factory-fabricated duct and fittings as indicated, or as installer's option in lieu of shop fabricated duct and fittings.

B. Round Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A 527 by the following methods and in minimum gauges listed.

1.

Duct Diameter	Minimum Gauge	Method of Manufacture
3" to 14" (75 mm to 300 mm)	26 (.5 mm)	Spiral Lockseam
15" to 26" (375 mm to 650 mm)	24 (.7 mm)	Spiral Lockseam
28" to 36" (700 mm to 850 mm)	22 (.8 mm)	Spiral Lockseam
38" to 50"	20 (1.0 mm)	Spiral Lockseam

(900 mm to 1250 mm)		
52" and larger (1300 and larger)	18 (1.3 mm)	Spiral Lockseam

2. Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct.
3. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams.

a.

Duct Diameter	Minimum Gauge
3" to 14" (75 mm to 300 mm)	24 (.7 mm)
15" to 26" (325 mm to 650 mm)	22 (.8 mm)
28" to 50" (700 mm to 1250 mm)	20 (1.0 mm)
50" to 60" (1250 mm to 1500 mm)	18 (1.6 mm)
62" and larger (1550 mm and larger)	16 (1.6 mm)

4. Inner Liner: Where indicated, provide inner liner, perforated with 3/32" (2.5 mm) holes for 22% open area. Provide metal spacers welded in position to maintain spacing and concentricity. Inner liner shall be as follows:

a. Ductwork: Up to 62" diameter, 26 gauge; over 62" diameter, 22 gauge.
b. Fittings: Up to 35" diameter, 24 gauge; over 35" diameter, 22 gauge.

C. Flat-Oval Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A 527 of spiral lockseam construction in minimum gauges listed.

1.

Duct Width	Minimum Gauge	Method of Manufacture
Up to 24" (Up to 600 mm)	24 (.7 mm)	Spiral Lockseam
25" to 48" (625 mm to 1200 mm)	22 (.8 mm)	Spiral Lockseam
49" to 70" (1225 mm to 1750 mm)	20 (1.0 mm)	Spiral Lockseam
Over 70" (Over 1750 mm)	18 (1.3 mm)	Spiral Lockseam

2. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous weld along seams.

a.

Duct Width	Minimum Gauge
Up to 36" (Up to 900 mm)	20 (1.0 mm)
37" to 60" (925 mm to 1500 mm)	18 (1.3 mm)
Over 60" (Over 1500 mm)	16 (1.6 mm)

3. Inner Liner: Where indicated, provide inner liner, perforated with 3/32" (2.5 mm) holes for 22% open area. Provide metal spacers welded in position to maintain spacing and concentricity. Inner liner shall be as follows:

a. Ductwork: Up to 60" duct width, 26 gauge; over 60" duct width, 22 gauge.
b. Fittings: Up to 35" width, 24 gauge; over 35" width, 22 gauge.

2.5 OUTDOOR DUCTWORK

A. All outdoor ductwork shall be double walled duct with fiberglass liner (3” for supply, 2” for return). In addition, duct shall be provided with an outdoor duct insulation system (see Division-23 section “HVAC Insulation” of these specifications) suitable for outdoor applications and U/V exposure. Provide aluminum saddles between duct insulation and duct supports to protect insulation. Contractor shall fasten ductwork to equipment supports as required to withstand windloading. Design of fastening system to withstand windloading shall be approved by a registered structural engineer.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK

A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (1% leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections within 1/8" (3 mm) misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling.

B. Supply ductwork within the mechanical equipment rooms shall be double walled, internally insulated (minimum 2" lining) (minimum 50 mm lining) with perforated galvanized liner. Ductwork outside of mechanical equipment rooms and within 25 feet (7500 mm) from each air handling unit shall also be double walled, internally insulated (minimum 2" lining) (minimum 50 mm lining) with perforated galvanized liner.

C. Round spiral ductwork shall be connected to the terminal units. Where duct diameter and box inlet differ, provide concentric factory fabricated high velocity adapters.

D. Seal all ductwork, after installation, in accordance with Seal Class "A" SMACNA Standards - Latest Edition.

E. Install concrete inserts, as required, for support of ductwork in coordination with formwork as required to avoid delays in work.

F. Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.

G. Locate ductwork runs except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or if not otherwise indicated. Run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" (13 mm) where furring is shown for enclosure or concealment of ducts but allow for insulation thickness, if any. Where possible locate insulated ductwork for 1" (25 mm) clearance outside of insulation. Wherever possible in finished and occupied spaces conceal ductwork from view by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions except as specifically

shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

H. Where ductwork is exposed to view in occupied areas, duct shall be double wall duct with internal lining, unless otherwise noted.

I. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and other electrical equipment spaces and enclosures.

J. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gauge as duct. Overlap opening on four (4) sides by at least 1-1/2" (40 mm).

K. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment controls and other associated work of ductwork system.

L. Support ductwork in manner complying with SMACNA Standards - latest edition of hanging and supporting systems chapter.

M. All exposed ductwork shall be primed and painted with paint appropriate for sheet metal surfaces. See architectural section "Painting".

N. Unless indicated otherwise, all stainless steel ductwork shall be welded.

3.2 CLEANING AND PROTECTION

A. Prior to installation, thoroughly clean ductwork internally of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless steel ductwork surfaces and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, install sheet metal temporary closures which will prevent entrance of dust and debris until the time all connections are to be completed.

3.3 DUCT TESTING

A. Prior to the balancing of systems by the AABC certified balancing contractor, all high pressure ductwork shall be tested by the mechanical contractor for duct leakage. Duct leakage shall not exceed 1% of design cfm for a duration of ten (10) minutes. Test pressures shall be not less than the following:

High Pressure Ductwork:	25% above system operating pressure, but not less than 6" w.c. (1500 Pa)

Insulation materials shall <u>not</u> be applied until systems have been witnessed, documented, and submitted to meet the above testing requirements.

B. The balance contractor shall witness and certify all duct pressure tests.

3.4 BALANCING

A. Refer to Division-23 section "Testing, Adjusting and Balancing" for air distribution balancing of high pressure ductwork; not work of this section.

END OF SECTION 23 31 14

SECTION 23 33 00

DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section and all other Division-23 sections.

B. Types of ductwork accessories required for project include the following:

1. Dampers:

a. Low pressure manual dampers
b. Control dampers
c. Counterbalanced dampers

2. Fire and smoke dampers
3. Turning vanes
4. Duct hardware
5. Duct access doors
6. Flexible connections
7. Penetration seals
8. Sound attenuators

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. SMACNA Compliance: Comply with applicable portions of latest edition of SMACNA Standards. In addition, all duct accessories shall comply with SMACNA's "Duct Cleanliness for New Construction Guidelines." The "Duct Cleanliness Level" for all ductwork shall meet the requirements of the "Advanced Level."
2. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
3. UL Compliance: Construct, test, and label fire, smoke and combination fire/smoke dampers in accordance with UL Standards 555 and 555S.
4. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

B. Duct Cleaning Contractor:

1. Duct cleaning contractor shall have been regularly engaged in commercial type duct cleaning services for a minimum of five (5) years of successful operation.
2. NADCA Certified: The duct cleaning contractor shall be certified by the National Air Duct Cleaners Association (NADCA).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, materials of construction and installation instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.

C. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and shop drawings in maintenance manual.

D. Duct cleaning contractor shall submit proposed approach, methodology and detailed cleaning and sanitizing process for each system listed above for approval prior to work being performed. In addition, provide documentation of NADCA certification, as well as five (5) years of successful performance.

PART 2 - PRODUCTS

2.1 DAMPERS

A. Low Pressure Manual Dampers: Provide dampers of single blade type or multiblade type, constructed in accordance with the latest edition of SMACNA Standards. Provide damper extender rods as required to compensate for external duct insulation.

B. Control Dampers: Refer to Division-23 section "Automatic Control Systems" for control dampers; not work of this section.

C. Counterbalanced Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at indicated static pressure. Construct blades of 16-gauge (1.6 mm) aluminum. Provide 1/2" (13 mm) diameter ball bearings, 1/2" (13 mm) diameter steel axles spaced on 9" (230 mm) centers. Construct frame of 2" x 1/2" x 1/8" ((50 mm x 13 mm x 3 mm) steel channel for face areas 25 sq. ft. (2.3 m^2) and under; 4" x 1-1/4" x 16-gauge (100 mm x 30 mm x 1.6 mm) channel for face areas over 25 sq. ft. (2.3 m^2). Provide galvanized steel finish on frame with aluminum touch-up.

2.2 FIRE AND SMOKE DAMPERS

A. Fire Dampers: Provide fire dampers where indicated and where required by NFPA and local authorities. Provide Type "C" fire dampers. Construction shall be in accordance with NFPA 90A and UL 555, and be UL labeled accordingly. Provide fusible link rated at 160°F to 165°F (71°C to 74°C) unless otherwise indicated. Provide damper with positive lock in closed position. Damper blades shall be fully out of the air stream. Horizontal installations shall have damper blades and closure spring out of air stream. Provide the following features:

1. Damper Blade Assembly: Curtain or multiple blade type.
2. Blade Material: Match casing and ductwork where installed.
3. Provide factory sleeve. Construction shall be minimum 20 gauge. Should duct be heavier than 20 gauge, provide sleeve and frame to

match duct and material construction. Sleeves shall be sufficient in length to protrude on both sides of the wall to allow for access door on one side and UL approved breakaway duct connection on both sides.

B. Motor Driven Combination Fire/Smoke Dampers: Provide motor driven fire/smoke dampers in types and sizes indicated and where required by NFPA and local authorities as indicated on the drawings. Dampers shall be multi-blade type with frames and blades constructed of galvanized steel. Dampers shall be UL 555 and 555S listed with Class I leakage characteristics at 250°F (8 CFM/ft^2 at 4" WG). Dampers located in medium pressure systems shall have air foil blades. Dampers in low pressure systems are to be standard "V" groove type. Dampers shall have factory sleeves meeting the requirements of UL. Electric actuators shall be provided by the damper manufacturer and installed at the factory externally on the damper sleeve. Actuators shall be UL approved as an assembly with the damper. Provide end position indicator switches for use by ATC. Duct type smoke detectors shall be furnished under Division-28.

1. Coordinate the damper voltage with the smoke/duct detector relay voltage.
2. See drawings for additional information regarding wiring of smoke and fire/smoke dampers.

C. Dampers shall be as manufactured by Ruskin, Greenheck, Nailor, Air Balance or Pottorff.

2.3 TURNING VANES

A. Manufactured Turning Vanes: Provide turning vanes constructed of 1-1/2" (40 mm) wide curved blades set at 3/4" o.c. (20 mm), supported with bars perpendicular to blades set at 2" o.c. (50 mm), and set into side strips suitable for mounting in ductwork.

2.4 DUCT HARDWARE

A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:

1. Test Holes: Provide duct test holes in ductwork at fan inlet and outlet, and elsewhere as indicated, consisting of slot and cover, for instrument tests.
2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12" (300 mm). Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

2.5 DUCT ACCESS DOORS

A. General: Provide duct access doors where required for duct accessory access. Provide access doors for fire dampers, smoke dampers and smoke detectors. Install access doors upstream of duct type smoke detectors.

B. Construction: Construct of same or greater gage as ductwork served and provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork and extended frames for externally insulated duct. Provide

one side hinged, other side with one handle-type latch for doors 12" (300 mm) high and smaller, 2 handle-type latches for larger doors.

2.6 FLEXIBLE CONNECTIONS

A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flame retardant fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

2.7 PENETRATION SEALS

A. Provide seals for all openings through fire-rated walls, floors or ceilings used as passage for mechanical components such as ductwork. See Division-23 section "Basic HVAC Materials and Methods" for penetration seals and firestopping requirements.

B. Provide seals for all openings through walls, floors or ceilings used as passage for mechanical components such as ductwork.

2.8 SOUND ATTENUATORS

A. General:

1. Sound attenuator manufacturer shall provide testing in accordance with ASTM E-477-2013.
2. Sound attenuator inlet and outlet connection dimensions must be equal to the duct sizes shown on the drawings. Duct transitions at sound attenuators are not permitted unless shown on the contract drawings.

B. Materials:

1. General:

a. Rectangular Attenuators: All rectangular attenuators shall be constructed with a 22 gauge galvanized steel outer casing and 26 gauge galvanized perforated steel inner wall.
b. Elbow Attenuators: All elbow attenuators shall be constructed with an 18 gauge galvanized steel outer casing and 22 gauge galvanized perforated steel inner wall. All acoustical splitters shall be internally radiused and aerodynamically designed for efficient turning of the air. Half and full splitters are required as necessary to achieve the scheduled insertion loss. All elbow attenuators with a turning cross-section dimension greater than 48” shall have at least two half splitters and one full splitter.
c. Circular Attenuators: All circular attenuators shall be constructed based on the following constraints:

1) Silencers with a diameter less than 18 inches shall be constructed of no less than 22 gauge casing and 26 gauge perforated metal.

2) Silencers with a diameter between 18 inches and 30 inches shall be constructed of no less than 20 gauge casing and 26 gauge perforated metal.
3) Silencers with a diameter between 30 inches and 54 inches shall be constructed of no less than 18 gauge casing and 22 gauge perforated metal.
4) Silencers with a diameter greater than 54 inches shall be constructed of no less than 18 gauge casing and 22 gauge perforated metal.

d. Access Doors: Where required, attenuators shall be supplied with an access door(s) to permit fire damper service. Access doors shall be supplied as an integral part of the attenuator by the attenuator manufacturer.

2. Dissipative Silencers:

a. Acoustic Media: Media shall be treated with an EPA registered non-toxic anti-microbial agent to protect against mold, mildew, bacteria and fungi. The media shall not contain formaldehydes, phenolic resins or volatile organic compounds (VOC's). The media shall comply with UL 181 and NFPA 90A.
b. Combustion Ratings: Attenuator materials, including glass fiber shall have maximum combustion ratings as noted below when tested in accordance with ASTM E84, NFPA 255 or UL 723.

Flame Spread Index:	10
Smoke Developed Index:	50

3. Film Lined Silencers:

a. The acoustic media shall be completely wrapped with Vibar™ film to help prevent shedding, erosion and impregnation.
b. Combustion Ratings: Attenuator materials, including glass fiber shall have maximum combustion ratings as noted below when tested in accordance with ASTM E84, NFPA 255 or UL 723.

Flame Spread Index:	25
Smoke Developed Index:	50

4. No-Media Silencers:

a. No-Media silencers shall not contain absorptive media of any kind. Attenuation shall be achieved with controlled impedance membranes and broadly tuned resonators.

C. Construction:

1. Sound attenuators shall be constructed in accordance with ASHRAE and SMACNA standards for the pressure and velocity classification specified for the air distribution system in which it is installed.
2. Material gauges noted in Paragraph B, are minimums.
3. Material gauges shall be increased as required for the system pressure and velocity classification. The attenuators shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge.

4. Where required, silencer shall be constructed from stainless steel or aluminum.
5. Casings shall be lockformed and sealed, except as noted in Paragraph B, to provide leakage-resistant construction. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite.
6. All perforated steel shall be adequately stiffened to insure flatness and form. All spot welds shall be painted.

D. Acoustic Performance:

1. Sound attenuator dynamic insertion loss shall not be less than that listed in the attenuator schedule.
2. Sound attenuator generated noise shall not be greater than that listed in the attenuator schedule.
3. Acoustic performance shall include dynamic insertion loss and generated noise for forward flow (air and noise in same direction) or reverse flow (air and noise in opposite direction) in accordance with the project's air distribution system requirements.
4. All attenuator ratings shall be determined in a duct-to-reverberant room test facility which provides for airflow in both directions through the test attenuator in accordance with the ASTM E-477-2013 test standard. The test set-up, procedure and facility shall eliminate all effects due to flanking, directivity, end reflection, standing waves and reverberation room absorption.

E. Aerodynamic Performance:

1. Attenuator pressure drops shall not exceed those listed in the attenuator schedule. Attenuator pressure drop measurements shall be made in accordance with the ASTM E-477-06a test standard. Tests shall be conducted and reported on the identical units for which acoustical data is presented.

F. Submittals:

1. Provide acoustical system calculations for all duct systems with attenuators to demonstrate that the resultant ductborne sound levels of the equipment as measured in the occupied spaces meet the specified criteria. In the absence of specified background sound level criteria, the guidelines as expressed in "Sound and Vibration Control" of the ASHRAE Handbook - HVAC Applications, shall be used.
2. The manufacturer shall supply certified test data for each scheduled attenuator. The data shall include dynamic insertion loss, generated noise and pressure drop for forward or reverse flow, matching the project's air distribution system requirement. All ratings shall be conducted in the same facility and shall utilize the same attenuator.

G. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work shall be limited to Vibro-Acoustics, Semco, Aerosonics, Ruskin or Price.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES

A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

B. Provide fire dampers where ducts penetrate a floor slab, and elsewhere as indicated.

C. Install balancing dampers where indicated, and at each ducted air inlet and outlet. Dampers are not required where a single air outlet occurs downstream of an air terminal (VAV's, fan powered boxes, etc.).

D. Install turning vanes in square or rectangular elbows (45 degrees and greater) in supply, return and exhaust air systems, and elsewhere as indicated.

E. Install airtight access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter. Duct access panels shall be adequately sized to provide access to all fire and/or smoke damper fusible links.

F. All electrical connections to smoke damper actuators and smoke detectors (duct or ceiling mounted) shall be provided by the ATC contractor.

G. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.3 DUCT CLEANING

A. Prior to cleaning or sanitizing ductwork/equipment, all equipment utilized to perform those processes shall be sanitized. Examine ductwork/equipment prior to performing work and provide new duct openings where required to provide visual inspection of the duct interior.

B. Unless indicated otherwise, the systems shall be cleaned and sanitized in the following order:

1. Exhaust systems
2. Return systems
3. Air handling unit(s)
4. Air handling unit supply systems

Duct cleaning of the above systems listed shall include air devices, terminal reheat units, etc.

C. Cleaning Process:

1. General:

   a. Systems shall be de-energized while duct cleaning and sanitizing are in progress.
   b. HEPA filter vacuums shall be used to keep room air clean. Ceiling tile shall be handled with care, and repaired or replaced as required to restore to the original condition.

2. Air Handler Cleaning Procedures:

   a. Vacuum completely, beginning with the area upstream of the filters. Filters shall be replaced at the completion of the work.
   b. Vacuum the fan and fan chamber.
   c. Wash/degrease fan blades as required.
   d. Wash/degrease chamber upstream of the coils as required.
   e. Clean coils.
   f. Sanitize.

3. Coil Cleaning Procedure: The procedure shall be customized to the situation encountered. The most heavily soiled coils may take a more complicated procedure of solution/pressure spraying. Most require only low pressure application of special cleaning solution and rinsing after they are first fully vacuumed.
4. Furniture Coverage from Incidental Dirt: As required, drape surrounding instruments, computers and areas with plastic to protect them from any incidental dirt generated during the cleaning process. Work environment shall be clean at all times. Floor shall be vacuumed as needed.
5. Duct Cleaning: Cleaning shall be accomplished by mechanical means in conjunction with the use of High CFM HEPA style vacuums and three (3) filtered canister vacuums. Mechanical means may include vacuum brushing of the duct interior, auger style mechanical devices, or high pressure air activated in duct cleaning devices to scrape off any dirt adhered to duct walls. Cleaning may be accomplished by a combination of these methods. Where possible, clean a full run or section before beginning another to insure full cleaning coverage. All material in the vacuum shall be disposed of daily after being treated with a sanitizer.
6. Sanitizing Process: Sanitizing shall be accomplished in two stages. First, it shall be done as each section of the air system is cleaned. The sanitization process shall be repeated again after the complete system has been cleaned. All sanitizing shall be completed before access is sealed. Diffusers shall be cleaned and sanitized. EPA recognized/registered sanitizers only shall be used. MSDS information shall be supplied for materials selected. Sanitizers/encapsulants shall not be used as a substitute for proper cleaning.
7. Clean Tests: Tests for bacteria/fungi shall be performed after all cleaning and sanitizing is completed to insure the clean standards have been met. This shall be done while the system is in operation and shall be a minimum of forty-eight (48) hours after the last sanitation has been completed.
8. Closing and Sealing: Provide galvanized sheet metal plate(s) to be used as access for the majority of locations. Square cut 22 gauge metal shall be used with each plate to lap its edges by one inch all around. Screws shall be placed at four inch (100 mm) intervals and the plate shall be

sealed with a water-based fireproof sealant to insure proper seal of the system to match existing pressure classification.

9. Encapsulation: There may be times when it is necessary to use an encapsulant on interior lined duct. It should be used only if circumstances require it (for example, the lining may be breaking down), and shall be agreed to in advance by the client. It shall not be used as a substitute for cleaning.
10. Duct cleaning shall be performed by Applied Building Technologies, Inc. or equivalent.

3.4 FIELD QUALITY CONTROL

A. Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

3.5 ADJUSTING AND CLEANING

A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper operation.

1. Final positioning of manual dampers is specified in Division-23 section "Testing, Adjusting and Balancing."

B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

C. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

3.6 EXTRA STOCK

A. Furnish extra fusible links to the Owner; one (1) link for every ten (10) installed of each temperature range.

END OF SECTION 23 33 00

SECTION 23 34 00

FANS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of fan work required by this section is indicated on drawings and schedules, and by requirements of this section and all other Division 23 sections.

B. Types of fans required for project include the following:

1. Centrifugal Fans
2. Tubular Centrifugal Fans
3. Inline Centrifugal Fans

C. Refer to the requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. AMCA Compliance: Provide fans bearing the AMCA Certified Ratings Seal. Sound rate fans in accordance with AMCA 300 "Test Code for Sound Rating Air Moving Devices".
2. ASHRAE Compliance: Test and rate fans in accordance with ASHRAE 51 (AMCA 210) "Laboratory Methods of Testing Fans for Rating".
3. UL Compliance: Provide fans electrical components which have been listed and labeled by UL.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for fans, including specifications, capacity ratings, fan performance curves with operating point clearly indicated, gages and finishes of materials, dimensions, weights, accessories furnished, and installation instructions.

B. Shop Drawings: Submit assembly-type shop drawings showing fan dimensions, required clearances, construction details, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to fan units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance instructions, including lubrication instructions, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver fans with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.

B. Handle fans carefully to avoid damage to components, enclosures, and finish. Do not install damaged components; replace and return damaged components to fans manufacturer.

C. Store fans in clean dry place and protect from weather and construction traffic.

D. Comply with manufacturer's rigging and installation instructions for fans, and moving them to final location.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL FANS

A. General: Provide centrifugal fans of sizes and arrangement as indicated, and of capacities and having accessories as scheduled.

B. Fans shall be backward inclined flat-bladed non-overloading fans. Fans with wheel diameter of 18-1/4" (463 mm) and larger shall be airfoil type, unless otherwise designated on plans.

C. Wheel diameters shall be in accordance with the standard sizes adopted by AMCA for non-overloading fans. Blades shall be welded to backplate and to spun inlet cone. Inlets shall be fully streamlined and housing shall be suitable braced to prevent vibration or pulsation.

D. Bearings shall be “Air Handling Quality Bearings” with an L10-200,000 hour rating based on the maximum speed range of the fan's AMCA class. Class III fans with bearings larger than 2-3/16" (55 mm) shall have double-row spherical split-housed bearings. All bearings shall be equipped with regreasable zerk fittings and grease lines extended to exterior of fan inlet collar.

E. Fan casings shall be rigidly built and braced. Bracing on the sides of the housings shall consist of structural angle iron extending the complete height of the unit. Housings with lock seams are not acceptable. Minimum gauges for Class I and Class II fans shall be as follows:

	Scroll	Sideplates
Sizes 12" - 27" (300 mm - 6575 mm)	14 ga. (2.0 mm)	12 ga. (2.8 mm)
Sizes 30" - 66" (750 mm - 1650 mm)	12 ga. (2.8 mm)	10 ga. (3.5 mm)

F. Class III fans shall have minimum 7 gauge (5 mm) scrolls and sideplates except for fans with smaller than 24-1/2" (620 mm) wheel diameter may have 10 gauge (3.5 mm) scrolls and sideplates. Round heavy gauge inlet collars shall be provided for all single width, single inlet fans. All fans shall have discharge flanges.

G. The fan shaft shall be designed so that first critical speed is a minimum of 1.35 times the maximum allowable speed for the fan class. Shafts shall be of solid hot-rolled steel accurately turned, ground, polished, and ring gauged for accuracy. All shafts must be dial indicated for straightness after the keyways are cut.

H. Both a static and dynamic balance shall be made on the fans after their assembly at the factory. The dynamic balance shall be made utilizing an IRD analyzer and final adjustment will be made to result in vibration amplitude not to exceed the acceptable levels on the Rathbone chart.

I. Fan performance shall be based on tests conducted in accordance with the AMCA Standard Test Code for Air Moving Devices. Fan shall be licensed to bear AMCA Certified Ratings Seal for Air and Sound. Performance curves shall be submitted for approval, and include static pressure, brake horsepower, and static efficiency plotted against air volume. Sound Power Levels by Octave Bands.

J. V-belt drives shall be selected for a minimum service factor or 1.5 at design operating speed. Fans with motors under 20 HP (15 kW) shall be furnished with adjustable V-belt drives, sized to give the required fan speed with motor sheave at the approximate midpoint of its range adjustment. Fans with motors 20 HP (15 kW) and larger shall be furnished with fixed pitch drives. Additional sheaves and belts shall be provided by the fan manufacturer at no additional cost, if required for final air balance.

K. All fans shall be furnished with flanged outlet, scroll access door and OSHA belt guard with tachometer opening at fan shaft. Fans exposed to weather shall be provided with weatherhoods over motors, shaft, bearings, and sheaves, and with drain fitting in bottom of scroll.

L. All other fan components, and all other fans, shall be thoroughly degreased and deburred before the application of a rust-preventative primer. After assembly, a second coat of enamel shall be applied to the complete assembly.

M. Fans shall be manufactured by Twin City, Buffalo, New York Blower or Aerovent.

2.2 TUBULAR CENTRIFUGAL FANS

A. General: Provide tubular centrifugal fans of size and capacity as indicated.

B. Wheel diameters shall be in accordance with the standard sizes adopted by AMCA for non-overloading fans. Blades shall be die-formed airfoil shaped, continuously welded to backplate and to wheel cone. The backplate of the wheel shall be specifically designed to offer lower resistance to the air leaving the impeller. Inlets shall be fully streamlined and housing shall be suitably braced to prevent vibration or pulsation.

C. Bearings shall be “Air Handling Quality Bearings” with an L10-200,000 hour rating based on the maximum speed range of the fan's AMCA class. All bearings shall be equipped with extended grease lines to zerk fittings on exterior of fan casing.

D. Fan casings shall be of steel, rolled and fully welded, 12 gauge (2.8 mm) minimum for wheel diameters through 27" (675 mm), 10 gauge (3.5 mm) minimum for wheel diameters through 66" (1680 mm), and 7 gauge for larger

sizes, with straightening vanes and inner shaft and bearing tube with integral belt tube. Casings shall have flanged inlet and outlets. Integral adjustable motor base shall be provided in location as indicated on the drawings.

E. The fan shafts shall be designed so that first critical speed is a minimum of 1.43 times the maximum allowable speed for the fan class. Shafts shall be solid hot-rolled steel accurately turned, ground, polished, and ring gauged for accuracy. All shafts must be dial indicated for straightness after the keyways are cut. Both a static and dynamic balance shall be made on the fans after their assembly at the factory. The dynamic balance shall be made utilizing the IRD analyzer and final adjustment shall be made to result in a vibration amplitude not to exceed the acceptable levels on the Rathbone chart.

F. Fan performance shall be based on tests conducted in accordance with the AMCA Standard Test Code for Air Moving Devices. Fan shall be licensed to bear AMCA Certified Ratings Seal. Performance curves shall be submitted for approval, and include static pressure, brake horsepower, and static efficiency plotted against air volume. Sound Power Levels by Octave Bands, based on AMCA's Standard 300-67, Test Set-up #1, shall be submitted, and shall be based on manufacturer's published catalog data.

G. V-belt drives shall be selected for a minimum service factor of 1.5 at design operating speed. Fans with motors under 20 HP (15 kW) shall be furnished with adjustable V-belt drives, sized to give the required fan speed with motor sheave at the approximate mid-point of its range adjustment. Fans with motors 20 HP (15 kW) and larger shall be furnished with fixed pitched drives. Additional sheaves and belts shall be provided by the fan manufacturer at no additional cost, if required for final air balance.

H. Each fan component shall be thoroughly degreased and deburred before the application of a rust-preventative primer. After assembly, a second coat of finish enamel shall be applied.

I. All fans shall be furnished with mounting legs or brackets for ceiling suspension as indicated on the plans, hinged casing access door (raised type for insulated fans), and OSHA belt guard. Companion flange shall be provided for attachment of flexible connections.

2.3 INLINE CENTRIFUGAL FANS

A. Fans shall be inline fans with non-overloading backwardly inclined wheels.

B. Wheel diameters shall be in accordance with the standard sizes adopted by AMCA for non-overloading fans. Wheels shall be all aluminum construction with extra wide backwardly blades for maximum efficiency and quiet operation.

C. Bearings shall be “Air Handling Quality Bearings” with an L10-200,000 hour rating based on the maximum allowable speed range of the fan.

D. Fan housings shall be of heavy gauge galvanized steel, suitably braced to prevent vibration and pulsation. Fans with 27" (675 mm) and larger wheels shall be provided with recessed unpunched flanges on inlet and discharge. All fans shall be equipped with support brackets suitable for horizontal, vertical and all-angle mounting. Integral adjustable motor mount shall be provided in location as indicated on the drawings.

E. The fan shafts shall be designed so that first critical speed is a minimum of 1.4 times the maximum allowable fan speed. Shafts shall be of solid hot-rolled steel accurately turned, ground, polished and ring gauges for accuracy.

F. Fans shall be provided with adjustable pitch V-belt drive and OSHA belt guard. Fans shall be designed for straight-through airflow, with fan bearings, fan and motor sheaves, belts, and motor completely isolated from the airstream and exterior to the fan housing, to facilitate inspection and maintenance. Fans shall be provided with bolted access door for wheel inspection and cleaning.

G. Fan wheel shall be statically and dynamically balanced, and the complete fan assembly shall be balanced at design operating speed prior to shipment.

H. All fans shall be licensed to bear the AMCA Certified Ratings Seal. Performance curves shall be submitted for approval, and include static pressure, brake horsepower, and static efficiency plotted against air volume. Sound Power Levels by Octave Bands, based on AMCA Standard 300, shall be submitted for approval. Fan sound power levels shall not exceed those listed on the drawings.

I. Fan shall be Twin City model SSI, Loren Cook, or equivalent.

2.4 MOTORS (TYPICAL FOR ALL FANS)

A. See Division-23 section, “Electrical Provisions for HVAC Equipment” for minimum motor efficiencies and other requirements.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF FANS

A. General: Install fans where indicated, in accordance with manufacturer's installation instructions, and with recognized industry practices, to ensure that fans comply with requirements and serve intended purposes.

B. Access: Provide access and service space around and over fans as indicated, but in no case less than that recommended by manufacturer.

C. Support: Provide 4" (100 mm) high concrete pad under floor-mounted fans.

D. Isolation: Set fans on vibration isolators, fasten in accordance with manufacturer's installation instructions.

E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Ensure that rotation is in direction indicated and intended for proper performance. Do not proceed with centrifugal fan start-up until wiring installation is acceptable to fan Installer.

F. Ductwork Connections: Refer to Division-23 ductwork sections. Provide flexible connections on inlet and outlet duct connections.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of fans, and after motor has been energized with normal power source, test equipment to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.

3.4 ADJUSTING AND BALANCING

A. Start-up, test, and adjust centrifugal fans in presence of manufacturer's authorized representative.

3.5 SPARE PARTS

A. General: Furnish to Owner, with receipt, one spare set of belts for each belt driven centrifugal fan.

END OF SECTION 23 34 00

SECTION 23 34 23

POWER AND GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of power and gravity ventilator work required by this section is indicated on drawings and schedules, and by requirements of this section and all other Division-23 sections.

B. Types of power and gravity ventilators specified in this section include the following:

1. Power ventilators:

a. Centrifugal roof ventilators
b. Wall mounted propeller fan

2. Ceiling ventilators:

a. Centrifugal ceiling exhausters
b. Toilet room exhausters

3. Gravity ventilators:

a. Hooded intake/relief devices
b. Louvered intake/relief housing

4. Prefabricated roof curbs

C. Refer to Division-07 sections for installation of prefabricated roof curbs; not work of this section.

D. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of power and gravity ventilators, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. AMCA Compliance: Provide power ventilators which have been tested and rated in accordance with AMCA standards, and bear AMCA Certified Ratings Seal for air and sound performance.
2. UL Compliance: Provide power ventilators which are listed by UL and have UL label affixed.
3. NEMA Compliance: Provide motors and electrical accessories complying with NEMA standards.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for power and gravity ventilators, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions.

B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, methods of assembly of components, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to power ventilators. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance data and parts list for each type of power and gravity ventilator, accessory, and control. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual.

PART 2 - PRODUCTS

2.1 POWER VENTILATORS

A. General: Except as otherwise indicated, provide standard prefabricated power ventilator units of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation.

B. Centrifugal Roof Ventilators:

1. Provide centrifugal roof type, curb mounted, power ventilators of type, size, and capacity as scheduled, and as specified herein.
2. Type: Centrifugal fan, direct or belt driven as scheduled. Provide one-piece heavy gauge, spun aluminum housing. Provide square base to suit roof curb. Provide belt driven fans unless otherwise indicated.

    a. Housing Design: Hooded dome type.
    b. Housing Design: Hooded low contour type.
    c. Housing Design: Upblast type.
    d. Housing Design: Louvered penthouse type.

3. Fans shall be statically and dynamically balanced.
4. Motor and fan assembly shall be on vibration isolating mounts.
5. Bird Screens: Provide removable bird screens, 1/2" (13 mm) mesh, 16-gauge (1.6 mm) aluminum or brass wire.
6. Dampers: Provide gravity-actuated louvered dampers in curb bases.
6. Dampers: Provide louvered motor operated dampers with linkage in curb base.
7. Fans and prefabricated roof curbs, where required, shall be the product of the same manufacturer.
8. For upblast type:

    a. Provide grease trough at the base of the housing.
    b. Fan discharge shall be a minimum of 40" (1000 mm) above roof.

c. Fan, curb assembly and associated ductwork shall comply with NFPA 96 "Vapor Removal from Commercial Cooking Equipment" requirements.

9. Electrical: Provide factory-wired non-fusible type disconnect switch at motor in fan housing. Provide thermal overload protection in fan motor. Provide conduit chase within unit for electrical connection.
10. Refer to Division-23 Automatic Control Systems sections for damper motor and control sequence; not work of this section.

C. Wall Mounted Propeller Fans:

1. Provide wall type propeller fans of type, size, and capacity as scheduled, and as specified herein.
2. Fan motors and drives shall be supported by heavy, steel frames welded to a steel panel. The panel shall include a venturi inlet and continuously welded corners.
3. Provide belt driven motors (unless otherwise noted); continuous duty, ball bearing type.
4. Blades shall be statically and dynamically balanced.
5. Electrical: Provide factory-wired non-fusible type disconnect switch at motor in fan housing. Provide thermal overload protection in fan motor. Provide conduit chase within unit for electrical connection.
6. Bird Screens: Provide removable bird screens, 1/2" (13 mm) mesh, 16-gauge (1.6 mm) aluminum or brass wire.
7. Dampers: Provide gravity actuated louvered dampers as indicated on plans.
8. Provide louvered motor operated damper with linkage. Refer to Automatic Control Systems sections for damper motor and control; not work of this section.

2.2 INLINE CENTRIFUGAL VENTILATORS

A. Centrifugal Ventilators:

1. Provide centrifugal ventilators of type, size and capacity as scheduled.
2. Type: Provide galvanized steel housing lined with acoustical insulation, adaptable for ceiling installation. Provide integral backdraft damper fan discharge.
3. Fans shall be grounded and mounted on vibration isolators.
4. Motor: Provide belt driven fan as indicated, unless otherwise noted.
5. Electrical: Provide junction box for electrical connection on housing, and receptacle for motor plug-in.

   a. Where indicated on plans, furnish remote fan speed control, solid state, capable of controlling fan speed from full speed to approximately half speed.

6. Entire fan, motor and wheel assembly shall be removable without disturbing the housing.
7. Accessories: Provide manufacturer's standard roof jack, wall cap, and transition fittings as indicated on drawings or schedules.

B. Ceiling Exhausters:

1. Provide ceiling exhausters, designed for ceiling mounting, of type, size, and capacity as scheduled.
2. Type: Provide galvanized steel housing lined with acoustical insulation. Fan and motor shall be removable from housing for service. Provide integral backdraft damper in fan discharge.
3. Grille: Where indicated on plans, provide egg-crate type face grille with 85% free area.
4. Motor: Provide permanent split-capacitor motor, permanently lubricated, with grounded cord and plug.
5. Electrical: Provide junction box for electrical connection on housing, and receptacle for motor plug-in.

    a. Where indicated on plans, furnish remote fan speed control, solid state, capable of controlling fan speed from full speed to approximately half speed.

6. Accessories: Provide the following accessories as indicated on drawings or schedule:

    a. Duct transitions

2.3 ROOF MOUNTED INTAKE/RELIEF DEVICES

A. General: Except as otherwise indicated, provide standard prefabricated intake/relief devices of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation.

B. Hooded Intake/Relief Devices: Provide hooded type, curb mounted, of size, type and capacity as scheduled, and as specified herein.

1. Type: Stationary, natural draft type. Provide weatherproof housing with square or rectangular base to suit roof curb.
2. Bird Screens: Provide removable bird screens, 1/2" (13 mm) mesh, 16-gauge (1.6 mm) aluminum or brass wire.
3. Dampers: Provide louvered motor operated dampers with linkage in curb base. Refer to Division-23 automatic control systems sections for damper motor and control sequence; not work of this section.
4. Unless otherwise noted, provide 2" (50 mm) throwaway type filters at fresh air intake hoods.

C. Louvered Intake/Relief Housing: Provide louvered type as indicated, of size and capacity as scheduled.

1. Construction: Design shall be watertight at normal positive pressure conditions, and to withstand wind load of 30 psf (1440 Pa).

    a. Louvers shall be heavy gauge extruded aluminum blades with corners mitered and welded.
    b. Structural framing of housing shall be sturdy galvanized steel members.

2. Dampers: Provide louvered motor operated dampers with linkage in curb base. Refer to Division-23 automatic control systems section for damper motor and control sequence; not work of this section.
3. Bird Screen: Provide removable bird screens, 1/2" (13 mm) mesh, 16-gauge (1.6 mm) aluminum or brass wire.
4. Unless otherwise noted, provide 2" (50 mm) throwaway type filters at fresh air intakes.

2.4 PREFABRICATED ROOF CURBS

A. General: Provide manufacturer's standard shop-fabricated units, modified if necessary to comply with requirements. Provide prefabricated roof curbs for each roof mounted fan and/or intake/relief device previously specified, and shall be the product of the manufacturer.

B. Fabricate structural framing for units of structural quality sheet steel (ASTM A 570, Grade 40), formed to profiles indicated or, if not indicated, to manufacturer's standard profiles for coordination with roofing, insulation and deck construction. Include 45 cant strips and deck flanges with offsets to accommodate roof insulation. Weld corners and seams to form watertight units.

1. Fabricate units from zinc-coated steel, ASTM A 446, Grade C, designation G90 hot-dip coating, mill phosphatized. Clean and paint with rust-inhibitive metal primer paint, of type recommended by manufacturer, 2.0 mils dry film thickness.

C. Reinforce continuous runs of over 3'-0" (900 mm - 0 mm) length by inserting welded stiffeners of heavy gauge with flanges as required to provide sufficient rigidity and strength to withstand maximum lateral forces in addition to superimposed vertical loads.

D. Sloping Roof Decks: For deck slopes of 1/4 per foot (20 mm/m) and more, fabricate support units to form level top edge.

E. Gage and Height: Fabricate units of metal gauge and to height above roof surface as indicated.

1. Where gage or height is not indicated, fabricate units of 18-gauge metal, and minimum height of 12" (300 mm).

F. Provide treated wood nailer, not less than 1-5/8" (40 mm) thick and of width indicated, but not less than width of support wall assembly. Anchor nailer securely to top of metal frame unit.

G. Provide lumber pressure treated with water-borne preservatives for "above ground" use, complying with AWPB LP-2.

H. Insulate units inside structural support wall with rigid glass fiber insulation board of approximately 3-lb. density (21 kPa) and 1-1/2" (40 mm) minimum thickness, except as otherwise indicated.

I. Provide support liners where shown, formed of 22-gauge (.85 mm) galvanized sheet metal, mill phosphatized, flanged at lower edges.

1. Extend support liners through deck construction to coordinate with ductwork below as indicated.
2. Use perforated metal for support liners, with approximately 1000, 3/32" (2 mm) diameter holes per sq. ft. (m^2), to provide sound absorbing surfaces.

    a. Provide sound insulation insert for curbs so indicated. Construct of 1" (25 mm) thick rigid fiberglass panels secured in galvanized steel framework, with rounded edges to minimize air flow resistance.

J. Provide burglar-proof grille in curb units for roof openings of more than 1'- 0" (300 mm - 0 mm) width. Fabricate grille of 3/4" (120 mm) diameter hardened steel bars, spaced 6" o.c. (150 mm) in one direction and 12" o.c. (300 mm) in other direction. Weld ends of bars to curb walls, and weld bars at intersections. Clean and paint with rust-inhibitive metal primer.

K. Metal Deck Reinforcement: Where indicated as integral part of support units, provide channel-shaped metal deck closure strips to reinforce opening through metal decking. Fabricate strips from 14-gauge (2 mm) metal to match metal and finish of curb units, except as otherwise indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which power and gravity ventilators are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF POWER AND GRAVITY VENTILATORS

A. General: Except as otherwise indicated or specified, install ventilators in accordance with manufacturer's installation instructions and recognized industry practices to insure that ventilators serve their intended function.

B. Coordinate ventilator work with work of roofing, walls, and ceilings, as necessary for proper interfacing.

C. Ductwork: Refer to Division-23 ductwork sections. Connect ducts to ventilators in accordance with manufacturer's installation instructions.

1. Provide access door in duct below ventilator to service damper.
2. Solder bottom joints and up 2" (50 mm) of side joints of duct under roof ventilator to retain any moisture entering ventilator.

D. Roof Curbs: Furnish roof curbs to roofing Installer for installation.

E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26

sections. Verify proper rotation direction of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

F. Remove shipping bolts and temporary supports within ventilators. Adjust dampers for free operation.

G. Fans and associated roof curbs and ductwork serving kitchen exhaust hoods shall comply with NFPA 96 "Vapor Removal from Commercial Cooking Equipment" requirements.

END OF SECTION 23 34 23

SECTION 23 34 25

KITCHEN MAKE-UP AIR UNIT AND EXHAUST FAN

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of rooftop unit work required by this section is indicated by requirements of this section and all other Division-23 sections.

B. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements:

1. ARI Compliance: Test and rate rooftop units in accordance with all applicable ARI standards including, but not limited to, ARI 210/240, 270, 340, 360 and 370.
2. ASHRAE Compliance: Construct refrigerating system of rooftop units in accordance with the most current edition ASHRAE 15.
3. Energy Compliance: Rooftop units shall meet or exceed the energy efficiency guidelines in accordance with, but not limited to, the most current versions of the following: ASHRAE 90.1 and Maryland Energy Efficiency Standards Act.
4. UL Compliance: Provide rooftop units which are designed, manufactured, and tested in accordance with UL requirements.
5. NFPA Compliance: Provide rooftop units which are in accordance with the most current editions of NFPA 90A and 90B.

B. Air Movement and Control Association Inc. (AMCA):

1. 99-0401-86 - Classification for Spark Resistant Construction

C. National Fire Protection Association (NFPA)

1. 70 - National Electrical Code
2. 90A-02 - Standard for the Installation of Air-Conditioning and Ventilating Systems
3. 96-04 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

D. Underwriters Laboratories (UL):

1. 507 - Electric Fans
2. 555 - Fire Dampers
3. 705 - Standard Power Ventilators
4. 762 - Standard Power Roof Ventilators for Restaurant Exhaust Appliances

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights, furnished specialties and accessories; and installation and start-up instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for supply wiring for rooftop units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance data and parts list for each rooftop unit, control, and accessory; including "trouble-shooting" maintenance guide. Include this data and product data in maintenance manual.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle rooftop units and components carefully prevent damage, breaking, denting and scoring. Do not install damaged rooftop units or components; replace with new.

B. Store rooftop units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with manufacturer's rigging and installation instructions for unloading rooftop units, and moving them to final location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Captive-Aire

B. Acceptable Manufacturers:

1. Greenheck, Captive-Aire

2.2 MANUFACTURED UNITS

A. Unit with Integral Heating shall be fully assembled at the factory and consist of an insulated metal cabinet, outdoor air intake weatherhood with aluminum mesh filter and bird screen, motorized intake damper, sensors, curb assembly, service receptacle, filter assembly for intake air, supply air blower assembly and an electrical control center. All specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection.

2.3 CABINET

A. Materials: Formed, double wall insulated metal cabinet fabricated to permit access to internal components for maintenance. Underside of unit shall have formed metal panels covering base panel insulation.

1. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvaneal steel. Base rail is 12 gauge, galvanized (G90) steel.
2. Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be minimum14 gauge galvanized (G90) steel.

B. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.

1. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.

a. Thickness: 1 inch (25 mm).
b. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
c. Location and application: Floor of each unit shall be insulated with 1 inch thick rigid fiberglass insulation, covered on one surface with integral aluminum foil. Full interior coverage of entire cabinet to include walls and roof of unit shall be semi-rigid type and installed between inner and outer shells of all cabinet exterior components when double walls are specified. Full interior coverage from “Heating on” entire unit.

C. Access Panels: Unit shall be equipped with insulated, hinged access panels to provide easy access to all major components. Access panels shall be fabricated of 18 gauge galvanized G90 steel. Removable access panels shall incorporate a formed drip edge.

D. Supply Air Blower Assembly: Blower assembly consists of an electric motor and a belt driven, double width, and double inlet forward curve blower. Assembly shall be mounted on heavy gauge galvanized rails and further mounted on spring isolation devices.

E. Control Center / Connections: Unit shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections.

F. Direct Gas-Fired Furnace:

1. Shall be factory assembled, piped and wired direct gas-fired system of 92% efficiency with a draw through design and field adjustable burner baffles with a direct spark ignition system.
2. Shall have a cast aluminum burner manifold and stainless steel mixing plates. No air from the inside space shall be allowed to pass across the burner at any time. Flame rectification shall be provided by a flame rod. A flame safeguard display shall be included. Burner control shall have a digital coded fault indicator capable of storing the last five faults.

3. Shall be equipped for operation on natural gas with a maximum rated inlet gas pressure of 2 psi. Gas pressure regulator shall be provided.
4. Shall have fault sensors as indicated on the drawings to provide fault conditions to optional digital controller or building controls.
5. Shall have temperature control provided by an electronic 25:1 turndown-ratio modulating discharge air sensor. Direct digital controller with integral discharge temperature limit using an external signal.
6. Shall include the following safety controls:

    a. Manual Reset, High Limit Switch: Main gas valve closes if high-limit temperature is exceeded.
    b. Dual safety shutoff valves shall be provided that do not exceed 120 VAC control signals.
    c. High and Low Gas Pressure Switch: Main gas valve closes if high or low pressure switch faults.
    d. FM global requirements: Include high and low gas pressure switches and visual indication gas valves.
    e. Two hydraulic proof of close valves(s) shall be included.
    f. A gas vent line shall be included that vents gas from between the safety shutoff valves.
    g. Visual indication: Clear visual signal demonstrating the position of the main gas safety shutoff valves.

G. Motorized Dampers / Intake Air: Motorized damper of insulated low leakage type shall be factory installed.

H. Sensors are considered to be part of various optional operational modes or device controllers and are to be factory supplied and installed as specified in other Divisions.

I. Curb Assembly: A curb assembly made of 14 gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit and shall have duct adapter(s) for supply air and exhaust air. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly.

J. Service Receptacle: 120 VAC GFCI service outlet shall be factory-provided and installed by this contractor in a location designated by the Architect.

2.4 BLOWER

A. Blower section construction, Supply Air: Belt drive motor and blower shall be assembled onto a minimum 14 gauge galvanized steel platform and must have helical coil spring vibration devices.

B. Blower Assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

C. Centrifugal Blower Housing: Formed and reinforced steel panels to make curved scroll housing with shaped cutoff.

D. Forward Curved Blower (Fan) Wheels: Galvanized or aluminum construction with inlet flange and shallow blades curved forward in direction of airflow. Mechanically attached to shaft with set screws.

E. Blower Section Motor Source Quality Control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, “Laboratory Methods of Testing Fans for Rating.”

2.5 MOTORS

A. General: Blower motors greater than ¾ horsepower shall be “NEMA Premium™” unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower and pulleys shall be fully machined cast-type, keyed and fully secured to the fan wheel and motor shafts. Electric motors of ten horsepower or less shall be supplied with an adjustable drive pulley. Comply with requirements in Division 23 05 13, matched with fan load.

B. Motors shall be as scheduled, and shall include inverter duty for variable frequency drive operation.

2.6 UNIT CONTROLS

A. The make-up unit and associated exhaust fan shall operate via the variable flow hood control system furnished and installed as part of the kitchen hood package by the Food Service Division. As part of this section, provide all wiring, devices, relays, control components, etc. to operate the make-up air unit and exhaust fan in accordance with hood control system. Refer to control sequence on mechanical and food service drawings for additional information. All control sequences and devices shall be integrated into the EMCS.

B. The unit shall be constructed so that it can function as a stand-alone heating system controlled by factory-supplied controllers, thermostats and sensors and it shall be operated as a heating system controlled by the Energy Management Control System (EMCS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.

C. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status, operating settings and alarm conditions. DDC controller shall have a built-in keypad to permit operator to access read-out screens and change settings without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable.

D. Remote Interface: Contractor shall provide and install a Remote Interface that functions as a remote indicator of owner-selected operating parameters and also permits remote inputting of new operating parameters. Each remote panel shall have a large LCD user interface screen similar in form and function to the screen

on the DDC. Installed location of room display shall be within the penthouse, unless otherwise directed in the field by the Owner or Architect. Provide necessary interface board to allow operation, scheduling, monitoring via the EMCS.

E. Sensors to be Provided with the Unit:

1. Room / Space Temperature Sensors
2. Heating Inlet Air Sensor
3. Dirty Filter Sensor
4. Fire Stat Type III
5. 120V/24V Smoke Detector

2.7 FILTERS

A. Unit shall have 2" thick MERV 8 disposable pleated filters located in the outdoor air intake and shall be accessible from the exterior of the unit.

2.8 BELT DRIVE ROOF UPBLAST CENTRIFUGAL EXHAUST FANS

A. General Description:

1. Discharge air up and away from the mounting surface.
2. Upblast fan shall be for roof mounted applications.
3. Performance capabilities up to 30,000 cubic feet per minute (cfm) and static pressure to 5 inches of water gauge.
4. Maximum continuous operating temperature is 400 Fahrenheit (204.4 Celsius).
5. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

B. Wheel:

1. Material type: non-stick coating
2. Non-overloading, backward inclined centrifugal
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency

C. Motors:

1. Motor Enclosures: Totally enclosed fan cooled.
2. Motors are heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase.
3. Mounted on vibration isolators, out of the airstream.
4. For motor cooling there shall be fresh air drawn into the motor compartment through an area free of discharge contaminants.
5. Accessible for maintenance.

D. Shafts and Bearings:

1. Fan shaft shall be ground and polished solid steel with an anti-corrosive coating
2. Permanently sealed bearings or pillow block ball bearings
3. Bearing shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed
4. Bearings are 100 percent factory tested
5. Fan shaft first critical speed is at least 25 percent over maximum operating speed

E. Housing:

1. Constructed of heavy gauge aluminum includes exterior housing, curb cap, windband, and motor compartment housing. Galvanized material is not acceptable.
2. Housing shall have a rigid internal support structure.
3. Windband to be one piece uniquely spun aluminum construction and maintain original material thickness throughout the housing.
4. Windband to include an integral rolled bead for strength.
5. Curb cap base to be fully welded to windband to ensure a leak proof construction. Tack welding, bolting, and caulking are not acceptable.
6. Curb cap to have integral deep spun inlet venturi and pre-punched mounting holes to ensure correct attachment to curb.
7. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.
8. Breather tube shall be 10 square inches in size for fresh air motor cooling, and designed to allow wiring to be run through it.

F. Vibration Isolation:

1. Double studded or pedestal style true isolators
2. No metal to metal contact
3. Sized to match the weight of each fan

G. Disconnect Switches:

1. NEMA Rated: 4X
2. Positive electrical shut-off
3. Wired from fan motor to junction box installed within motor compartment

H. Drive Assembly:

1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower
2. Belts: Static free and oil resistant
3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts
4. The motor pulley shall be adjustable for final system balancing
5. Readily accessible for maintenance

I. Drain Trough:

1. Allows for one-point drainage of water, grease, and other residues

J. Options/Accessories to be Provided:

1. Auto Belt Tensioner:

   a. Automatic tensioning device that adjusts for the correct belt tension, only for single drives.

2. Birdscreen:

   a. Material Type: Aluminum
   b. Protects fan discharge

3. Clean Out Port:

   a. Removable grease repellent compression rubber plug allows access for cleaning wheel through windband.

4. Curb Extension:

   a. Type: SB
   b. Material Type: Aluminum
   c. Coating: Hi-Pro Polyester

5. Curb Seal:

   a. Rubber seal between the fan and the roof curb

6. Dampers:

   a. Type: Motorized
   b. Prevents outside air from entering back into the building when fan is off
   c. Balanced for minimal resistance to flow
   d. Galvanized frames with prepunched mounting holes

7. Drain Connection:

   a. Constructed of aluminum
   b. Allows singe-point drainage of grease, water, or other residues

8. Finishes:

   a. Types: Hi-Pro Polyester

9. Grease Trap:

   a. Constructed of aluminum
   b. Includes drain connection
   c. Collects grease residue
   d. Optional with grease absorbent sock

10. Hinge Kit:

    a. Aluminum hinges

b. Allows the fan to tilt away for access to wheel and ductwork for inspection and cleaning.

11. Hinge Base:

a. Aluminum hinges
b. Hinges and restraint cables are mounted to a base (sleeve)
c. Allows the fan to tilt away for access to wheel and ductwork for inspection and cleaning.

12. Heat Baffle:

a. 1 inch thick insulation shield that prevents heat from radiating into the motor compartment.

13. Tie-Down Points:

a. Four brackets located on windband secures fan in heavy wind applications

14. Windband Extension:

a. Constructed of aluminum with rolled beads
b. Raises fan discharge an additional 36 inches

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which rooftop units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PACKAGED KITCHEN MAKE-UP AIR UNIT

A. General: Install rooftop units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Support: Install units on roof curb, in accordance with National Roofing Contractor's Association (NRCA) installation recommendations.

C. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment Installer.

D. Ductwork: Refer to Division-23 ductwork sections. Connect supply and return ducts to unit with flexible duct connections. Provide transitions to exactly match unit duct connection sizes.

E. Start-up rooftop units, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

1. Balancing of rooftop unit systems is specified in Division-23 section "Testing, Adjusting and Balancing"; not work of this section.

F. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

3.3 GROUNDING

A. Provide positive equipment ground for rooftop unit components.

3.4 SPARE PARTS

A. General: Furnish to Owner, with receipt, the following spare parts for each rooftop unit:

1. One set of matched fan belts for each belt-driven fan.
2. One set of filters for each unit.

END OF SECTION 23 34 25

SECTION 23 35 10

LAUNDRY ROOM VENTING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish and install a packaged mechanical dryer venting system and associated modulating combustion air supply system as shown on the drawings and as specified, complete, including the following:

1. Packaged ventilator/control combination, listed to UL 705, Standard for Power Ventilators as a complete system.
2. Packaged ventilator/control combination, listed to UL 1995, Standard for Safety Heating and Cooling Equipment and CAN/CSA C22.2 No. 236 as a complete system.
3. Electrical connections.
4. Duct connections.

1.2 CODES AND STANDARDS

A. In addition to Division-23 Section, “Basic HVAC Requirements,” the following published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section:

1. UL – Underwriters Laboratories
2. National Electrical Code
3. National Fuel Gas Code/ANSI Z223.1
4. Uniform Mechanical Code (UMC)
5. International Mechanical Code (IMC)
6. International Fuel Gas Code

1.3 QUALITY ASSURANCE

A. All equipment and accessories shall be the product of a manufacturer regularly engaged in its manufacture and shall be of a standard catalog product.

B. Mechanical venting system and combustion air supply system guaranteed shall operate satisfactory and efficiently without objectionable exhaust or odor.

C. Scheduled equipment performance shall be the minimum capacity required.

D. Scheduled electrical capacity shall be considered as maximum available.

E. Equipment shall be manufactured at an ISO 9001 certified plant.

1.4 SUBMITTALS

A. System vendor shall coordinate equipment product data submittal sheets and shall provide a comprehensive set of interfaced drawings and duct design calculations, which shall serve as the basis for system evaluation by consulting engineer.

B. Submit the following to the Owner's Representative.

1. Ventilator descriptive literature, dimensional diagram and electrical diagram.
2. Control descriptive literature, dimensional diagrams and electrical diagrams.
3. Specification review with respect to submitted equipment identifying all areas of compliance and exceptions.
4. Certification of listing by recognized testing laboratory.

C. Manufacturers not named in these specifications, but those that have received prior approval by the consulting engineer as required within 10 days prior to bid date, shall be permitted one opportunity to receive formal submittal approval. If the consulting engineer does not grant this approval, the contractor shall submit on the manufacturer named in these specifications only or the contractor will be charged for the submittal review time for alternate manufacturers.

1.5 OPERATING AND MAINTENANCE MANUALS

A. Provide to Owner's Representative complete Operation and Maintenance manuals with product literature on the ventilator and controls, dimensional and wiring diagrams.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, MECHANICAL DRYER VENTING SYSTEMS

A. Furnish mechanical dryer venting and modulating combustion air supply system, with design volume and design pressure as scheduled on the drawings as manufactured by Exhausto (UEP), or equivalent.

2.2 MECHANICAL DRYER VENTING SYSTEM DESIGN

A. The ventilator must be suitable for indoor and outdoor installation. The housing shall have duct connections and be designed so the entire impeller and motor assembly can be removed as a unit. Housing must be resistant to corrosion. It must have a service door that can be opened for easy cleaning and service. The ventilator must be rated for operating temperatures of 575°F.

B. The backward inclined impeller shall be made in cast aluminum and be completely in balance. The impeller must be balanced statically and dynamically, and balancing weights must be permanently attached.

C. The motor(s) must be a totally enclosed, fan cooled variable speed motor with pre-lubricated and sealed ball bearings requiring no further maintenance, and rated as shown on the fan schedule. To assure motor longevity the motor shall not operate at speeds above 1720 RPM.

D. The modulating fan control, EBC30, must be a true PID control and must be able to maintain a constant pressure, between 0.012"W.C. and 0.568"W.C with a tolerance of 0.004"W.C., by modulating ventilator speed. It must be designed so it can maintain a pressure setting. It must be able to adjust to the proper setting in less than 20 seconds after an adjustment is made necessary. The control shall include a duct probe with tubing and a transducer, XTP, to be located in the duct as shown on the manufacturer's submittal. The XTP shall be field wired to the EBC30. When providing combustion air to a mechanical room it shall also include an outdoor pressure probe with tubing along with and XTP-transducer. The system must have these features:

1. "Plug-and-Play" self-check that detects connections, setting requirements and accessories.
2. Means to set the required duct pressure and a LCD-panel to display the value. The LCD-panel must also be able to show the actual duct pressure.
3. Programmable microprocessor for selective programming of purge times, sensor sensibility, alarm limits and delays, language, manual overrides, manual functions, low limit and high limit ventilator speeds and more via the programming panel and via an RS-232 port.
4. Choice of intermittent and continuous ventilator operation.
5. A standard board that interlocks with up to 6 dryers so a call for heat activates the ventilator and release the burner once an adequate, pre-set pressure has been established.
6. The proven draft function must be an integral part of the control to avoid external wiring to separate switch(es). It must be able to be set for automatic or manual reset.
7. Operating Priority option, which allows one or more appliances to operate during electrical or mechanical failure of the ventilator, provided the pressure requirement can be met and safe operation assured. Set up of a default Operating Priority must be possible, so most the important appliance(s) have highest priority during calls for heat. It must automatically check for ventilator operation every two hours and go back to normal operation if appropriate.
8. Adjustable pre-purge, so the control will allow the ventilator to prime the duct prior to appliance startup.
9. Adjustable post-purge, so the control will allow the ventilator to operate for up to 3 minutes after the burner has shut down. It shall have a 12-second built-in delay function to avoid nuisance cutouts.
10. Bearing cycle activation every 7 days in case the ventilator has not been operating during the past 7 day period.
11. Means to set the required duct pressure and a LCD-panel to display the value. The LCD-panel must also be able to show the actual duct pressure.
12. Self-diagnostics panel with LED-diodes for verification of proper operation.
13. Alarm functions with fault code showing on LED-display as well as a visual alarm.
14. The control must be able to maintain an error log so the last 10 fault codes can be retrieved.

E. Furnish a variable frequency drive, Danfoss Model VLT2800, programmed for and approved to operate the ventilator(s), as shown on plans. It shall be immune to electromagnetic interference.

2.2 MODULATING COMBUSTION AIR SUPPLY SYSTEM DESIGN

A. The ventilator must be suitable for indoor installation. The housing shall have duct connections and be designed so the entire impeller and motor assembly can be removed as a unit. Housing must be resistant to corrosion. It must have a service door that can be opened for easy cleaning and service.

B. The forward inclined impeller shall be made in steel and be completely in balance.

C. The motor(s) must be a totally enclosed, fan cooled variable speed motor with pre-lubricated and sealed ball bearings requiring no further maintenance, and rated as shown on the fan schedule. To assure motor longevity the motor shall not operate at speeds above 1720 RPM.

D. The modulating fan control, EBC30, must be a true PID control and must be able to maintain a constant pressure of 0.012”W.C. with a tolerance of 0.004”W.C., by modulating ventilator speed. It must be designed so it can maintain a pressure setting in a mechanical room and a separate draft pressure setting in a chimney. It must be able to adjust to the proper setting in less than 20 seconds after an adjustment is made necessary. The control shall include an outdoor probe with tubing and a transducer, XTP, to be located in the mechanical room as shown on the manufacturer’s submittal. The XTP shall be field wired to the EBC30. The system must have these features:

1. “Plug-and-Play” self-check that detects connections, setting requirements and accessories.
2. Means to set the required room pressure and a LCD-panel to display the value. The LCD-panel must also be able to show the actual pressure.
3. Programmable microprocessor for selective programming of purge times, sensor sensibility, alarm limits and delays, language, manual overrides, manual functions, low limit and high limit ventilator speeds and more via the programming panel and via an RS-232 port.
4. Choice of intermittent and continuous ventilator operation.
5. A standard board that interlocks with up to six (6) boilers so a call for heat activates the ventilator and releases the burner once an adequate, pre-set room pressure has been established.
6. The proven pressure function must be an integral part of the control to avoid external wiring to separate switch(es). It must be able to be set for automatic or manual reset.
7. Operating Priority option, which allows one or more appliances to operate during electrical or mechanical failure of the ventilator, provided the pressure requirement can be met and safe operation assured. Set up of a default Operating Priority must be possible, so most the important appliance(s) have highest priority during calls for heat. It must automatically check for ventilator operation every two hours and go back to normal operation if appropriate.
8. Adjustable pre-purge, so the control will allow the ventilator to prime the mechanical room prior to appliance startup.
9. Adjustable post-purge, so the control will allow the chimney ventilator to operate for up to 3 minutes after the burner has shut down. It shall have a 12-second built-in delay function to avoid nuisance cutouts.
10. Bearing cycle activation every seven (7) days in case the ventilator has not been operating during the past seven (7) day period.
11. Means to set the required room pressure and a LCD-panel to display the value. The LCD-panel must also be able to show the actual pressure.

12. Self-diagnostics panel with LED-diodes for verification of proper operation.
13. Alarm functions with fault code showing on LED-display as well as a visual alarm.
14. The control must be able to maintain an error log so the last 10 fault codes can be retrieved.

E. Furnish a variable frequency drive, Danfoss Model VLT2800, programmed for and approved to operate the chimney fan(s), as shown on plans. It shall be immune to electromagnetic interference.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Complete structural, mechanical, and electrical connections in accordance with manufacturers' printed instructions.

B. Installing contractor shall install all Mechanical Dryer Venting System components as indicated on drawings, including low voltage wiring from XTP-sensor to EBC30 controller and line voltage wiring from EBC30 to the ventilator. He must ensure the following.

1. Allow satisfactory arrangement in the space available.

C. Connecting to Duct:

1. Install per plans and in accordance with manufacturer's printed instruction.

3.2 OPERATING TESTS, START-UP, AND ON-SITE SERVICES

A. System vendor's service organization shall employ senior service technicians having experience in all aspects of trouble shooting, corrective service, and preventive maintenance O&M reporting.

B. After installation is completed:

1. Test the operation of the mechanical dryer venting and combustion air supply system and:

a. Increase and decrease pressure setting.
b. Increase and decrease firing rate.

2. Test safety control by firing dryer and:

a. Shut off the ventilator
b. Shut off the control.

B. Submit a written report signed by manufacturer's authorized representative, confirming that safety and operating controls have been properly installed.

3.3 OPERATING INSTRUCTIONS

A. Instruct Owner's Representative and designated personnel in the proper operation and maintenance of the packaged system.

3.4 MANUFACTURERS WARRANTY

A. All equipment is to be guaranteed against defects in materials and/or workmanship for a period of 24 months from the date of installation, or 30 months from date of shipment, whichever occurs first. The warranty shall be provided by the equipment vendor and shall include the parts necessary to repair or replace all defective parts and materials.

B. The ventilator shall be covered by a 10-year warranty against corrosion perforation.

END OF SECTION 23 35 10

SECTION 23 36 00

AIR TERMINALS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of air terminals work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of air terminals specified in this section include the following:

1. Air Terminals

a. Single Duct Variable Air Volume (VAV)
b. Exhaust and Return Terminals

C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. ARI Compliance: Provide air terminals which have been tested and rated in accordance with the most current version of ARI Standard 880 "Industry Standard for Air Terminals" and bear ARI certification seal. Sound level adjustment factors shall be based on the most current version of ARI Standard 885. Coils shall be ARI 410 rated and certified.
2. NFPA Compliance: Construct air terminals using acoustical and thermal insulations complying with NFPA 90A "Air Conditioning and Ventilating Systems".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including performance data for each air terminal furnished; schedule showing drawing designation, room location, number furnished, model number, size, Noise Criteria (NC) levels for discharge and radiated sound, static pressure loss, and accessories furnished. Also, provide installation and start-up instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

C. Wiring Diagrams: Submit ladder-type wiring diagrams for electric power and control components, clearly indicating required field electrical connections.

D. Maintenance Data: Submit maintenance data and parts list for each type of air terminal; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and maintenance data in maintenance manual.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver air terminals wrapped in factory-fabricated fiberboard type containers. Identify on outside of container type of air terminal and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in boxes.

B. Store air terminals in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work shall be limited to the following:

1. Titus
2. Krueger
3. Price
4. Nailor
5. Anemostat
6. ETI

2.2 SUPPLY AIR TERMINALS

A. General: Provide factory-fabricated and tested air terminals as indicated, selected with performance characteristics which match or exceed those indicated on schedule.

B. Casing/Insulation: Unit casing shall be 22 (.8 mm) gauge galvanized steel, internally insulated. Insulation shall be as follows:

1. Insulation shall be 1" (25 mm), 1-1/2 pound density (10 kPa) fiberglass insulation which complies with UL 181 and NFPA 90A. All exposed insulation edges shall be coated with an NFPA 90A approved sealant to prevent erosion. Fiberglass insulation shall contain an EPA registered antimicrobial agent which resists the growth of bacteria and fungi as proven by tests in accordance with ASTM G21 and G22. Internal insulation shall be lined with a non-porous sealed type lining such that fiberglass insulation is not exposed to the airstream. Foil lining shall comply with NFPA 90A and UL 101.

C. Leakage: Construct casings and dampers such that when subjected to 3.0-in w.g. (747 Pa) pressure, total leakage does not exceed maximum values indicated below. Casing leakage rate shall include leakage from the entire terminal unit assembly from inlet connection through a factory mounted reheat coil (where applicable).

Inlet Size	Casing Leakage	Damper Leakage
5, 6	4 cfm (1.9 L/s)	5 cfm (2 L/s)
8	6 cfm (2.8 L/s)	5 cfm (2 L/s)
10	8 cfm (3.8 L/s)	5 cfm (2 L/s)
12	9 cfm (4.3 L/s	5 cfm (2 L/s)

D. Air Dampers: Construct of non-corrosive heavy gauge metal with shaft rotating on self-lubricating bearings. Provide mechanism to vary air volume from minimum to maximum in response from signal from thermostat.

E. Provide a factory mounted control enclosure.

F. Provide an access panel in bottom of air terminal.

G. Controls: Unit controls shall reset supply air volume to within 5% of design air flow regardless of system pressure.

1. Temperature control contractor shall provide direct digital controllers (DDC) as specified in other Division-23 sections. DDC controllers shall be shipped from the ATC contractor to the air terminal manufacturer for factory installation by the air terminal manufacturer.
2. Units shall have pressure independent control. Air flow limiters will not be accepted.

H. Identification: Provide label on each unit indicating size designation, CFM range and CFM factory-setting.

I. Sound: The manufacturer shall furnish certified sound power levels, and associated Noise Criteria (NC) levels, for both discharge and radiated sound, tested in accordance with the most current ASHRAE standards and ARI standard 880. The tests shall be conducted in an ARI-ADC approved sound facility. The following sound adjustment factors shall be utilized for each terminal unit to determine resulting sound levels within the occupied spaces:

		dB reduction (2nd thru 7th octave bands)					
		2	3	4	5	6	7
Discharge:	5" inlet	16	12	9	7	8	9
	6" inlet and above	18	13	11	10	11	12
Radiated:	5" inlet and above	17	18	19	25	30	33

The above attenuation values include environmental adjustment factor, branch power division, end reflection, space effect, ceiling tile loss, etc. Additional attenuation factors shall not be used and will not be acceptable. Where lined (fiberglass) ductwork is indicated on the drawings, attenuation reduction values indicated in the most current version of ARI standard 885 can be utilized up to a maximum of five (5) feet of lined ductwork.

Maximum Noise Criteria (NC) levels, indicated on the mechanical drawings, shall not be exceeded in the 2nd thru 7th octave bands at the design inlet static pressure indicated on the schedule (typically 1.5 in. w.c.). Where required, provide sound attenuators for discharge noise control, and/or GWB backed acoustical ceiling tile (gypsum wall board with 3-1/2" batt insulation attached to ceiling tile) for a radius of 15 feet from the VAV terminal for radiated noise control, to obtain Noise Criteria (NC) levels indicated on the drawings. Sound

attenuator shall be manufactured such that fiberglass is not exposed to the airstream.

J. Hot Water Reheat Coils: Provide heating coils constructed of copper tubes and aluminum fins. Coils shall be internally mounted in the casing at the factory. Heating coils shall be by terminal unit manufacturer.

2.03 EXHAUST AND RETURN TERMINALS

A. Exhaust terminals shall be of similar construction to supply terminal units specified in paragraph 2.02 of this section, unless otherwise noted. For exhaust air terminals, provide flow-cross, velocity pressure type, air flow sensors. Internal insulation, reheat coil and bottom access panel are not required. Exhaust terminals shall be provided by the same manufacturer as the supply terminals. Unit shall be Titus QCV or equivalent.

B. Sound: The manufacturer shall furnish certified sound power levels, and associated Noise Criteria (NC) levels, for both discharge and radiated sound, tested in accordance with the most current ASHRAE standards and ARI standard 880. The tests shall be conducted in an ARI-ADC approved sound facility. The following sound adjustment factors shall be utilized for each terminal unit to determine resulting sound levels within the occupied spaces:

	dB reduction (2nd thru 7th octave bands)					
	2	3	4	5	6	7
Discharge: 5" inlet and above	16	12	9	7	8	9
Radiated: 5" inlet and above	17	18	19	25	30	33

The above attenuation values include environmental adjustment factor, branch power division, end reflection, space effect, ceiling tile loss, etc. Additional attenuation factors shall not be used and will not be acceptable.

Maximum Noise Criteria (NC) levels, indicated on the mechanical drawings, shall not be exceeded in the 2nd thru 7th octave bands at the design inlet static pressure indicated on the schedule (typically 1.5 in. w.c.). Where required, provide sound attenuators for discharge noise control, and/or GWB backed acoustical ceiling tile (gypsum wall board with 3-1/2” batt insulation attached to ceiling tile) for a radius of 15 feet from the VAV terminal for radiated noise control, to obtain Noise Criteria (NC) levels indicated on the drawings. Sound attenuator shall be manufactured such that fiberglass is not exposed to the airstream.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which air terminals are to be installed. Do not proceed with work until satisfactory conditions have been corrected.

3.2 INSTALLATION OF AIR TERMINALS

A. General: Install air terminals as indicated, and in accordance with manufacturer's installation instructions.

B. Location: Install each unit level and accurately in position indicated in relation to other work; and maintain sufficient clearance for normal service and maintenance, but in no case less than that recommended by manufacturer.

C. Code Clearance: The installation shall provide adequate clearances in accordance with the latest edition of the National Electrical Code (NEC) for all components (DDC controllers, electric coil accessories, etc.) associated with the air terminal units.

D. Duct Connections: The sheet metal contractor shall provide a minimum of three (3) duct diameters, but not less than three feet (3′), of straight, rigid duct upstream of the terminal unit inlet.

E. Insulation: The Contractor shall insulate all external portions of the coil and /or coil section to prevent condensation.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation and prior to initial operation, test and demonstrate that air terminals and duct connections to air terminals are leak-tight.

B. Repair or replace air terminals and duct connections as required to eliminate leaks, and retest to demonstrate compliance.

3.4 CLEANING

A. Clean exposed factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 23 36 00

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section and all other Division-23 sections.

B. Types of air outlets and inlets required for project include the following:

1. Ceiling air diffusers
2. Registers and grilles

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
5. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:

1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, Noise Criteria (NC) levels, static pressure loss, and accessories furnished.
2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work shall be limited to the following:

1. Titus
2. Krueger
3. Price
4. Nailor
5. Anemostat
6. Metalaire

2.2 CEILING AIR DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have, as a minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule. The following requirements shall apply to nomenclature indicated on schedule:

E. Diffuser Materials:

1. Aluminum Construction: Manufacturer's standard extruded aluminum frame and adjustable blades.

F. Diffuser Faces:

1. Square: Square housing, core of square concentric louvers, square or round duct connection. (See drawings).
2. Rectangular: Rectangular housing, core of rectangular concentric louvers, square or round duct connection. (See drawings).
3. Perforated: Square, housing covered with removable perforated panel in frame. Conceal air pattern devices above panel.
4. Linear: Extruded aluminum continuous slot, single or multiple.

G. Diffuser Mountings:

1. Stepped-Down: Diffuser housing below ceiling with perimeter flange and gasket to seal against ceiling construction.
2. Flush: Diffuser housing above ceiling surface with flush perimeter flange and gasket to seal against ceiling.
3. Lay-In: Diffuser housing sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.

H. Diffuser Patterns:

1. 1-Way: Fixed louver face for 1-direction air flow, direction indicated on drawings.
2. 2-Way: Fixed louver face for 2-direction air flow, directions indicated on drawings.
3. 3-Way: Fixed louver face for 3-direction air flow, directions indicated on drawings.
4. 4-Way: Fixed louver face for 4-direction air flow, directions indicated on drawings.

I. Diffuser Dampers:

1. Fire Damper: Where indicated, provide combination adjustable opposed blade damper and fusible link fire damper with UL approved link and assembly designed to meet requirements of NFPA 90A.

J. Diffuser Finishes:

1. Aluminum Enamel: Air-dried aluminum enamel prime finish.
2. White Enamel: Semi-gloss white enamel prime finish.

3. Aluminum Anodize: Aluminum etched and anodized, covered with clear lacquer finish.

2.3 REGISTERS AND GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide registers and grilles that have, as a minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Surface Compatibility: Provide registers and grilles with border styles that are compatible with adjacent surfaces, and that are specifically manufactured to fit with accurate fit and adequate support. Refer to general construction drawings and specifications for types of construction which will contain each type of register and grille.

D. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule. The following requirements shall apply to nomenclature indicated on schedule:

1. Register and Grille Materials:

   a. Aluminum Construction: Manufacturer's standard extruded aluminum frame and adjustable blades.

2. Register and Grille Faces:

   a. Horizontal Fixed Blades: Horizontal blades, fixed at 35 degrees, with 3/4" (20 mm) spacing. Blades shall be parallel to long dimension.
   b. Aluminum Grid - Eggcrate type: 1/2" x 1/2" x 1/2" (13 mm x 13 mm x 13mm) aluminum grid and border.

3. Register and Grille Patterns:

   a. Single Deflection: 1-set of blades in face.

4. Register and Grille Finishes:

   a. Aluminum Enamel: Air-dried aluminum enamel prime finish.
   b. White Enamel: Semi-gloss white enamel prime finish.
   c. Aluminum Anodize: Aluminum etched and anodized, covered with clear lacquer finish.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions. Air outlets and inlets shall be independently supported from the structure at two (2) locations and in accordance with recognized industry practices to insure that products serve intended functions. The ceiling or ceiling grid shall not be considered as a means of support.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

D. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

END OF SECTION 23 37 00

SECTION 23 40 00

AIR CLEANING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of air cleaning work required by this section is indicated on drawings and schedules, and by requirements of this section and all other Division-23 sections.

B. Types of air cleaning equipment specified in this section include the following:

1. Air Filters:

a. Replaceable (throwaway)
b. Extended surface
c. Extended surface, self-supporting
d. High efficiency particulate air (HEPA)

2. Filter Holding Systems:

a. Front and rear access filter frames
b. Side servicing housings
c. HEPA

3. Filter Gages

C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. NFPA Compliance: Comply with applicable portions of NFPA 90A and 90B, and NEC pertaining to installation of air filters and associated electric wiring and equipment.
2. UL Compliance: Comply with UL Standards pertaining to safety and performance of air filter units.
3. ASHRAE Compliance: Comply with provisions of ASHRAE Standard 52 for method of testing, and for recording and calculating air flow rates.
4. ARI Compliance: Comply with provisions of ARI Standard 850 pertaining to test and performance of air filter units.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data including, dimensions, weights, required clearances and access, flow capacity including initial and final pressure drop at rated air flow, efficiency and test method, fire classification, and installation instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for filter rack assemblies indicating dimensions, materials, and methods of assembly of components.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to air filter units. Submit manufacturer's ladder-type wiring diagram for control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance data and spare parts lists for each type of filter and rack required. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual.

PART 2 - PRODUCTS

2.1 AIR FILTERS

A. Replaceable (Throwaway) Panel Pre-filters: Provide factory-fabricated, viscous-coated, flat panel type replaceable air filters with holding frames; as indicated, in sizes indicated, with 2" (50 mm) thick UL Class 2 throwaway media material; construct media of interlaced glass fibers, spray with non-flammable adhesive, frame in throwaway fiberboard casings, and sandwich between perforated metal grills. Construct ductwork-holding frames of 20-gauge (1.0 mm) galvanized steel, capable of holding media and media frame in place, and gasketed to prevent unfiltered air by-passing between media frames and holding members. Provide filters with rated face velocity of 500 fpm (2.5 m/s), initial resistance of not greater than 0.30" w.g. (75 Pa), final rated resistance of 0.50" w.g. (125 Pa), 30% ASHRAE 52.1-1992 efficient with a minimum MERV of 6.

B. Extended Surface Filters: Provide factory-fabricated, dry, extended surface filters with holding frames; where shown, in sizes indicated. Equip with UL Class 1 fibrous media material formed into 6" (150 mm) deep V-shaped pleats and held by self-supporting wire frames. Construct holding frames of 18-gauge (1.3 mm) galvanized steel and provide suitable fasteners and gasketing to hold media and media frame and to prevent unfiltered air passing between media frames and holding devices. Design holding frames which are suitable for bolting together into built-up filter banks. Provide filters with rated face velocity of 500 fpm (2.5 m/s) with 60-65% ASHRAE efficiency (minimum MERV of 11), 80-85% ASHRAE efficiency (minimum MERV of 13) or 90-95% ASHRAE efficiency (minimum MERV of 14).

C. Extended Surface Self-Supporting Filters: Provide factory-fabricated, dry, extended surface self-supporting filters with holding frames; where indicated, in sizes indicated. Equip with UL Class 1 fibrous media material constructed so that individual pleats are maintained in tapered form by flexible internal supports under rated air flow conditions. Construct holding frames of 18-gauge (1.3 mm) galvanized steel and provide suitable fasteners and gasketing to hold filter units and to prevent unfiltered air passing between media frames and holding devices. Design holding frames which are suitable for bolting together into built-up filter banks. Provide filters with rated face velocity of 500 fpm (2.5 m/s) with 60-65% ASHRAE efficiency (minimum MERV of 6), 80-85% ASHRAE efficiency (minimum MERV of 13) or 90-95% ASHRAE efficiency (minimum MERV of 14).

D. High Efficiency Particulate Air (HEPA) Filters: Provide factory-fabricated high efficiency particulate air filters with holding casing; where shown, in sizes indicated. Provide glass fiber media, rated UL Class 1 and with dustspot efficiency of not less than 99.97%, when tested with 0.3 micron particles in accordance with MIL-F-51068, and with static pressure drop of not greater than 1.0" w.g.(250 Pa), when clean and operating at rated capacity. Equip filters with gaskets and construct media of continuous sheets with closely spaced pleats separated by corrugated aluminum inserts. Construct holding casing of 18-gauge (1.3 mm) galvanized steel, complete with gaskets and holding latches and capable of being bolted together, or held with retainers, to form filter bank with airtight joints. Construct downstream corners of holding device with cushion pads to protect media. Provide filters 11-1/2" (290 mm) deep with rated face velocity of 250 fpm (1.3 m/s), initial operating resistance of 1.0" w.g. (250 Pa), and recommended final resistance of 2.0" w.g. (500 Pa) Provide minimum 2" (50 mm) replaceable pre-filters upstream of HEPA filters.

2.2 FILTER HOLDING SYSTEMS

A. Front and Rear Access Filter Frames: Provide filter bank framing system, constructed of aluminum framing members having minimum thickness of 0.09" (2.3 mm). Design system for either upstream (front) or downstream (rear) filter servicing. Cut to size and pre-punch members for easy assembly into modules of size and capacity as scheduled or noted on drawings. Provide permanently gasketed framing members to prevent bypass of unfiltered air. If vertical support members are required to prevent deflection of horizontal members, install so as not to interfere with either installation or operation of filters. Incorporate separate track for pre-filters, removable from front or removable from back after removal of after-filters. Provide factory-installed positive sealing device for each row of filters, to insure seal between gasketed filter elements. Provide hardware necessary for field assembly.

B. Side Servicing Housings: Provide factory-assembled side servicing housings with flanges for insertion into ductwork system as indicated. Construct of 16-gauge (1.6 mm) galvanized steel. Provide integral pre-filter tracks to accommodate 2" (50 mm) throwaway or cleanable filters. Provide access doors with continuous gasketing on perimeter and positive locking devices. Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames to prevent bypass. Arrange so filter cartridges can be loaded from either access door.

2.3 HEPA FILTER HOLDING SYSTEMS

A. Provide bag-in, bag-out factory assembly side service filter housing with flanges for insertion into the duct system(s) indicated. The filter housing shall accommodate 2-inch (MERV 8) pre-filters as well as HEPA or ULPA filters. The units shall be provided with, but not limited to, the following:

1. Stainless steel construction (304 stainless) rated to withstand 15 inches of positive or negative pressure without failure.
2. Access doors with continuous high memory silicone gasketing.
3. Bagging ring assembly with 8-mil poly vinyl chloride filter bags and banding kit.
4. Filter seal assembly with adjustment up to 1400 lbs of filter seal pressure to prevent air bypass around filters.

5. Bubble-tight shut-off dampers on the inlet and outlet of the filter housing assembly.
6. Decontamination ports on upstream and downstream side of filters
7. Lifting lugs (304 stainless steel)
8. All plenums and transitions required for a complete assembly to mate with adjacent equipment and/or ductwork.
9. Differential pressure gages for permanent pressure monitoring as well as pressure taps for independent testing.
10. Housing shall be pressure tested to a minimum of 6-inches water column, with zero leakage.

2.4 FILTER GAGES

A. Provide magnehelic filter gauges for each filter bank graduated to read from 0 to 3" w.g. (0 to 750 Pa).

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which air filters and filter housings will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION

A. General: Comply with installation requirements as specified elsewhere in these specifications pertaining to air filters housing/casings and associated supporting devices.

B. Install air filters and holding devices of types indicated, and where shown; in accordance with air filter manufacturer's written instructions and with recognized industry practices; to ensure that filters comply with requirements and serve intended purposes.

C. Locate each filter unit accurately in position indicated, in relation to other work. Position unit with sufficient clearance for normal service and maintenance. Anchor filter holding frames securely to substrate.

D. Coordinate with other work including ductwork and air handling unit work, as necessary to interface installation of filters properly with other work.

E. Install filters in proper position to prevent passage of unfiltered air.

F. Install electrical devices furnished by manufacturer but not specified factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment Installer.

G. Install magnehelic gauges upstream and downstream of filters to indicate air pressure drop through air filter. Mount filter gauges on outside of filter housing or filter plenum, in accessible position. Adjust and level inclined gauges if any, for proper readings.

3.3 FIELD QUALITY CONTROL

A. Operate installed air filters to demonstrate compliance with requirements. Test for air leakage of unfiltered air while system is operating. Correct malfunctioning units at site, then retest to demonstrate compliance, otherwise, remove and replace with new units, and proceed with retesting.

3.4 EXTRA STOCK

A. Provide one (1) complete extra set of filters for each air handling system. If system is designed to include pre-filters and after-filters, provide only pre-filters. Install new filters at completion of air handling system work, and prior to testing, adjusting, and balancing work. Obtain receipt from Owner that new filters have been installed.

END OF SECTION 23 40 00

SECTION 23 52 23

HIGH EFFICIENCY CAST-IRON BOILERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of cast-iron boiler work required by this section is indicated on drawings and schedules, and by requirements of this section and all other Division-23 sections. This section also includes specifications for furnishing and installing non-positive and positive pressure vent systems for condensing and non-condensing applications.

B. Types of cast-iron boilers specified in this section include the following:

1. Cast-iron sectional gas-fired boilers
2. Flue venting for boilers

C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements:

1. I=B=R Compliance: Provide cast-iron boilers that have been tested and rated in accordance with Institute of Boiler and Radiator Manufacturers (I=B=R) "Testing and Rating Standard for Cast-Iron and Steel Heating Boilers", and bear I=B=R emblem on nameplate affixed to boiler.
2. NFPA Compliance: Install gas-fired cast-iron boilers in accordance with National Fire Protection Association (NFPA) Code 54 "National Fuel Gas Code".
3. ASME Compliance: Construct cast-iron boilers in accordance with American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section IV and provide low water cut-off as per ASME CSD-1.
4. UL Labels: Provide cast-iron boiler ancillary electrical components which have been listed and labeled by Underwriters Laboratories (UL).
5. State Requirements: Comply with requirements of the State of Maryland.
6. Where applicable, products furnished under this section shall conform to the requirements of NFPA 54 and NFPA 211, and shall comply with UL 1738, ULC S636 Standard for Venting Systems for Category II, III, and IV Gas-Burning Appliances, and all other applicable standards. Also approved for use with Type L Venting systems (gas or oil) in accordance with UL 641.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights (shipping, installed, and operating), furnished specialties and accessories; and installation and start-up instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

C. Wiring Diagram: Submit ladder-type wiring diagrams for power and wiring required for final installation of cast-iron boilers and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance data and parts list for each cast-iron boiler, control, and accessory; including "trouble-shooting" maintenance guide. Include this data and product data in maintenance manual.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle cast-iron boiler sections and equipment carefully to prevent damage, breaking, and scoring. Do not install damaged sections or components; replace with new.

B. Store cast-iron boiler sections and equipment in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

PART 2 - PRODUCTS

2.1 GENERAL

A. Reference is made to the clause entitled “Buy American Act – Balance of Payments Program – Construction Materials” FAR 52.225-9. Notwithstanding a bidder’s right to offer identifiable foreign construction material in its bid pursuant to FAR 52.225-9, the awarding authority does not anticipate accepting an offer that includes foreign construction material.

B. All manufacturers to be considered shall be required to meet or exceed scheduled I=B=R capacities and ratings and will be held to strict compliance with these contract specifications. For factory assembled, packaged and firetested boilers, the complete boiler shall be approved as a unit by Underwriters Laboratories.

C. Installing contractor shall include, as part of his contract, all charges and costs for boiler and burner testing, start-up, checkout, adjusting, field and state inspections, including service contracts for systems and equipment as here-in-after specified. Provide signed documentation to the awarding authority for completion of specified procedures.

D. Contractor shall obtain certificate of boiler inspection after boiler installation has been completed and pay all fees associated with such inspection. After receipt of certificate of inspection, installing contractor shall furnish a suitable glass front frame in which to place said certificate. Frame, with inspection certificate inserted therein, shall then be placed on or posted in a suitable location within the boiler room in which the new boilers have been installed.

E. Installing contractor shall obtain from the boiler manufacturer pertinent (O&M) operating, testing, and cleaning instructions for the boilers, burners, controls and safety devices furnished with the Boiler(s).

F. It shall be the responsibility of the installing contractor to deliver O&M manuals, together with complete wiring and piping diagrams, to the owner/user and to obtain a receipt for the instructions. The receipt shall be filed with the installation report.

G. Written notification specifying the name, address, telephone number and available service program of a third party burner service group as herein specified.

2.2 WARRANTY

A. The manufactured heating units, equipped with cast iron/metal push nipple connectors, the boiler manufacturer shall warrant that the cast iron sections of each boiler will be free from defects in material and workmanship under normal usage for a period of ten years from the date of original installation.

1. Burners: The burner manufacturer shall warrant each burner for a period of 24 months from date of shipment.
2. Vent shall be warranted by the manufacturer against defects in material and workmanship for a period of (15) years from the date of manufacture.

2.3 3-PASS CAST IRON BOILER – MODEL - MPC

A. Hot water boiler shall be a high efficiency, pressurized, cast iron sectional wet base boiler and not require a refractory combustion chamber. It shall be suitable for forced draft firing and capable of achieving a minimum combustion efficiency of 88% fired with No. 2 oil and 85% fired with gas. Thermal efficiency shall be a minimum of 86% with No. 2 oil and 83% fired with gas. Heat transfer shall be enhanced by the addition of removable baffles.

B. Boiler shall be a 3-pass cast iron sectional type design with large combustion chamber and horizontal flue passes with cast fins. Class 25 high silicone content cast iron shall provide resistance to temperature variations and thermal stress. A high-temperature silicone-coated fiberglass rope gasket will be compressed into a cast tongue and groove connection around the perimeter of the section, providing a durable, gas tight seal.

C. Boiler shall have a return mixing tube with drilled openings in each section, allowing proportionate distribution of return water throughout the entire section assembly. Cool return water shall be pre-heated by the hot supply water as it enters the section assembly thereby reducing thermal stress on individual sections without the use of external mixing devices. Boiler supply water temperatures, measured on the supply manifold shall be no less than 130ºF. Return water coming back to the boiler may be no less than 80ºF. System piping shall be sized for a maximum temperature difference between the boiler supply and return water of 40ºF. However, a maximum delta T of 80ºF across the boiler is allowable.

D. A single supply water manifold shall be located at the rear of the boiler with eight tappings for the installation of temperature and pressure controls, gauges, probe-type low water cut-offs, and electronic control sensors. A single top rear return connection shall be considered standard equipment.

E. Boiler shall be furnished as a knocked down unit for field erection. Sections shall be assembled using precision machined cast iron push nipples.

1. USE FOR FACTORY PACKAGED AND FIRE TESTED: Boiler shall be factory assembled and installed on a structural steel frame/base, completely packaged with burner and controls mounted and wired. Burner shall be factory fire tested to ensure proper operation before shipment. Boiler jacket shall bear the UL (Underwriters Laboratories) logo and comply with all UL795 (gas) and UL 726 (oil) safety standards. Section assembly shall be hydrostatically pressure tested @ 120 PSI prior to shipment. Packaged boiler shall be shrink wrapped for protection.

F. Cast iron burner swing door shall be lined with lightweight refractory insulation and shall have reversible hinges, allowing a minimum of 90° swing to the left or right side of boiler, allowing unobstructed access to combustion chamber and flue passages. The flue passages and combustion chamber shall be accessible from the front of the boiler for cleaning, and from the back of the boiler to vacuum soot and combustion residue from the fireside.

G. Rear flue collector, with test tapping, shall be constructed of cast iron and shall be concealed under a highly insulated boiler jacket.

H. Boiler shall be equipped with a flange mounted flame retention type burner. Input, output and combustion efficiency shall be certified to efficiency test procedures specified in I=B=R/BTS-2000. Boiler efficiencies must meet ASHRAE 90.1 and the National Energy Policy Act of 1992 requirements.

I. Boiler shall be constructed for 80 PSI water working pressure in accordance with the ASME Section IV Rules for Construction of Heating Boilers. Individual sections shall have been subjected to a hydrostatic pressure test of 200 PSIG at the factory before shipment and they shall be stamped or cast with the ASME ‘H’ symbol.

J. The boiler shall be provided with a heavy duty 20 gauge steel jacket with modular 4-inch thick insulation and have a rust resistant powder coat finish. The boiler jacket shall contain a concealed electrical chaseway for power and limit circuit

wiring within the top jacket panels, providing a clean finished look when the jacket is installed. Individual lift-off jacket side panels may be installed after system piping and allow ease of access to the boiler sections.

K. Boiler trim shall include:

1. One (1) 3-1/2" inch dia. combination pressure-temperature gauge.
2. Safety high limit aquastat; auxiliary safety high limit aquastat with manual reset (must specify on order); low fire hold aquastat (LHL and full modulation burners only).
3. (USE FOR FULL MODULATION) Firing rate controller.
4. Dial type stack thermometer, minimum 3" dial face, ½" NPT connection.
5. ASME Section IV safety relief valve sized to exceed the gross output of the boiler which shall be factory set to relieve pressure at (30) (50) (80) PSI water working pressure.
6. One (1) low water cutoff device with manual reset, to comply with CSD-1 requirements. Boiler shall be fitted with a probe type LWCO located above the lowest safe permissible water level established by the boiler manufacturer. LWCO shall be UL listed and FM approved, suitable for commercial hydronic heating service at 80 PSI.
7. Provide coverplate on swing door to conceal boiler insulation.

L. Burner shall be Power Flame Type CG with Fuel/Air Control System that is low-high-low gas. The flame safeguard control shall be Honeywell RM 7895 with key pad display. All burner controls and the gas train must meet CSD-1 Code. The combustion air and damper interlocks, as well as the electrical requirements must meet CSD-1.

M. Provide station to support burner assembly, if required.

N. Provide boiler accessories for normal system operation including pressure relief, boiler blowdown, etc.

2.4 BOILER CONTROL SYSTEM (ECM ELECTRONIC CONTROL MODULE)

A Scope of Supply:

1. Supply a boiler control system to provide safety interlocks and water temperature control. The control system shall be fully integrated into the burner control cabinet and incorporate single and multiple boiler control logic, inputs, outputs and communication interfaces. The control system shall coordinate the operation of up to eight (8) fully modulating hot water boilers and boiler pumps. The control system shall simply control boiler modulation and on/off outputs based on the boiler water supply temperature and an operator-adjusted setpoint. However, using parameter menu selections, the control system shall allow the boiler to respond to remote system water temperature and outside air temperatures with domestic hot water priority (DHWP) and warm weather shut down (WWSD) or building automation system (BAS) firing rate demand, remote setpoint or remote start/stop commands.

B. Boiler Control:

1. Using PID (proortional-integral-derivative) based control, the remote system water temperature shall be compared with a setpoint to establish a target boiler firing rate. If the secondary loop GPM is greater than the primary loop GPM, firing rate is increased in response to the decrease in secondary loop temperature. When the remote system temperature is near the boiler high limit temperature, the boiler supply sensor shall limit the maximum boiler supply temperature to prevent boiler high limit trips. Alternately, using parameter menu selections, the control system shall allow the boiler to respond directly to boiler supply temperature and setpoint to establish a target boiler firing rate while remote system water temperature is used for display purposes only. Each boiler's fuel flow control valve shall be mechanically linked to the air flow control device to assure an air rich fuel/air ratio. All the automated logic required to ensure that pre-purge, post-purge, light-off, and burner modulation shall be provided.

C. Hot Water Temperature Setpoint:

1. When the controller is in the local control mode, the control system shall establish the setpoint based on outside air temperature and a reset function curve, or be manually adjusted by the operator. When enabled, the setpoint shall be adjusted above a preset minimum setpoint upon sensing a domestic hot water demand contact input. When in remote mode, the control system shall accept a Modbus or 4-20mAdc remote setpoint or firing rate demand signal from an external BAS.

D. User Interface:

1. A panel front-mounted English language, two line, sixteen character LCD message display shall be provided to display numeric data, startup and shutdown sequence status, alarm, system diagnostic, first-out messages and boiler historical information. Historical information shall include the last ten lockout and alarm conditions, number of boiler cycles, boiler hours and last ten low boiler return temperature events. When boiler return water temperature is below a minimum setpoint a low temperature events shall be stored with time, date, "lowest temperature for event" and "duration below setpoint" data. A panel mounted red alarm light shall annunciate alarm messages. Alarm conditions requiring a manual reset shall be annunciated by a flashing red light. At a minimum, the boiler system shall display the following:
2. Numeric Display with Engineering Units:

    a. Boiler Supply Water Temperature
    b. Boiler Return Water Temperature
    c. Remote System Temperature (when required by contract drawings)
    d. Outside Air Temperature (when required by contract drawings)
    e. Firing Rate %
    f. Boiler Temperature Setpoint
    g. Mixing Valve % (when required by contract drawings)

.

3. Status, Startup and Shutdown Sequence English language Messages:

   a. Boiler Disabled
   b. Warm Weather Shutdown
   c. Lockout
   d. Pump Purge
   e. Limit Hold
   f. Purge / Pilot Ignition
   g. Low Fire / Pilot Ignition
   h. Main Burner Ignition
   i. Boiler Running
   j. Fan Post Purge
   k. Pump Cooldown
   l. Standby

4. Alarm, System Diagnostic, First-Out English language Messages: (numeric code numbers shall not be acceptable):

   a. Low Water Level (when required by contract drawings)
   b. Low Water Flow (when required by contract drawings)
   c. Fuel Limit (gas pressure or oil temperature)
   d. High Boiler Supply Temperature Limit
   e. Low Return Water Temperature
   f. Low Air Flow
   g. Flame Safeguard Internal Fault
   h. High Supply Temperature
   i. Supply Temperature Sensor Fault
   j. Return Temperature Sensor Fault
   k. Outside Air Temperature Sensor Fault
   l. Remote System Temperature Sensor Fault
   m. Remote Input Signal Fault
   n. Modbus Communication Fault
   o. Memory Fault

E. Flame Safeguard (FSG):

1. An industrial duty microprocessor-based FSG shall provide: safety interlocks, flame monitoring protection and timed sequences. Sequences shall include forced draft fan start and stop, furnace purge, burner light-off and shutdown and post-purge. FSG components shall be fully integrated for automatic sequencing of light-off and shutdown.

F. Boiler Pump Sequence:

1. Include primary water pump control to allow boiler warm-up to the return water temperature before the boiler start; continue water flow for an adjustable cool down period after the boiler has stopped; and ensure water is always moving past the remote system temperature sensor even after the last boiler has been stopped. The pump shall immediately stop if any trips occur during pre-purge, pilot, or main flame trial for ignition.

G. Flue Gas Condensate Protection:

1. Include alarms and control logic to help prevent corrosion in the boiler due to sustained flue gas condensation. These features become increasingly important as we add energy savings modulation and outdoor

air reset functions. Provide a 4-20mAdc, 3 way mixing valve control output based on PID control, measured boiler return temperature and minimum return temperature setpoint or measured boiler return and supply temperature difference and differential setpoint. If the boiler return water temperature drops below setpoint or the differential temperature is excessive the valve shall open to allow hot boiler supply water to blend with cold return water temperature. The valve repositions toward 0% recirculation after return water temperature increases above setpoint. Low boiler return water temperature shall be alarmed using an alarm message, indicating light and an alarm contact output. Excessively low boiler return temperature events shall be stored with boiler historical data.

H. Communication:

1. Include an RS485 modbus slave or peer-to-peer communications data highway on each boiler control system. When peer-to-peer communication is enabled the data highway shall allow the connected boilers to exchange signals as required to provide coordinated fully modulating lead/lag functions. It shall not be required to wire individual control signals between boilers. When modbus communication is enabled the data highway shall allow individual boiler limits, lockout, boiler and system temperatures and firing rate status to be readable and water setpoint, boiler firing rate, and start/stop command to be readable and writable. Provide all equipment capabilities specified in this paragraph, even if a connecting Supervisory Control and Data Acquisition System (SCADA), typically a desk top personal computer) system is not included in this project.
2. Provide interface board as required to operate with DDC EMCS system provided under another Division.

I. Quality Assurance:

1. The boiler control system shall be supplied as part of a factory assembled, tested burner control cabinet.

2.5 SPECIAL GAS VENT – FLUE VENTING FOR BOILERS

A. Vent shall be factory-built special gas type, double wall, engineered and designed for use on Category I, II, III, and IV appliances, or as specified by the equipment manufacturer.

B. Maximum continuous flue gas temperature not to exceed 550°F (288°C) for gas burning appliances. Maximum temperature for appliances approved to vent with Type L-Vent (gas) is 570°F (299°C).

C. Vent shall be constructed with an inner conduit constructed of AL29-4C® or 29-4 (S44735) superferritic stainless steel with a minimum thickness of .015” for diameters 3”-8” and 020” for diameters 10”-16”.

D. Vent shall be listed for an internal static pressure of 15” w.g. and tested to 37” w.g.

E. All inner wall conduit components shall be manufactured from AL29-4C® or 29-4 (S44735). The joint closure system shall be an Inner Wall Mechanical Locking Strap design. Joints shall not use screws or fasteners that penetrate the inner conduit.

F. Vent shall be constructed with a factory installed gasket used to seal the joint for diameters 4"–16". Use of gasket lube, available from the factory, should be used for maximizing gasket life and ease of installation. For diameters 18"- 32", joints shall be sealed with factory supplied RTV sealant.

G. Inner wall joints shall be designed with a male and female overlapping metal-metal connection to maintain condensate on the AL29-4C stainless steel. Proper ¼" per foot pitch must be maintained at all times and condensate should flow back toward the appliance to the required number of drains.

H. The outer wall casing shall be constructed of 430 stainless steel that shall not require additional surface preparation, such as painting, in order to withstand the outdoors or high humidity environments.

I. Inner conduit and outer wall casing shall be constructed with a one-inch air space between them and in such a fashion that prevents cross-alloy contamination.

J. Tees and elbows shall provide a pressure drop less than 15 feet equivalent horizontal vent.

K. Fittings that increase or decrease vent diameter shall be asymmetric in construction with a flat wall that maintains a straight line with adjoining parts in order to facilitate the unobstructed flow of all condensate.

L. All parts shall be compatible with other single wall and double wall products of the same manufacturer.

M. System is to be sized in accordance with the appliance manufacturer's specifications, NFPA 54-National Fuel Gas Code (ANSI Z223.1), ASHRAE recommendations, and other applicable codes.

N. Vent shall be Heatfab Saf-T Vent CI Plus, or approved equivalent.

O. Sealant: General Electric RTV106 (aka Momentive) or Dow Corning 736 High Temperature Sealant shall be used to seal all joints on systems where the maximum flue gas temperature will not exceed 550°F.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which cast-iron boilers are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CAST-IRON BOILERS

A. General: Comply with boiler manufacturer's instructions for installation, except as otherwise indicated.

B. Comply with installation requirements of local and state boiler codes, and applicable provisions of NFPA and ASME boiler code standards, and as indicated below.

C. Install cast-iron boilers on 4" (100 mm) high concrete pad where indicated, maintain manufacturer's recommended clearances around and over top of boilers.

D. Install boiler trim not installed at the factory.

E. Connect water, fuel, blowdown piping, and breeching as indicated.

F. Furnish to Electrical Installer, manufacturer's wiring diagram and electrical requirements for installation of field-wiring required for cast-iron boilers; not work of this section.

G. Flush and clean cast-iron boilers upon completion of installation, in accordance with manufacturer's start-up instructions.

H. Start-up cast-iron boilers, in accordance with manufacturer's start-up instructions, and in presence of boiler manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

I. Hydrostatically test assembled boiler and piping in accordance with applicable sections of ASME Boiler and Pressure Vessel Code.

J. Arrange with National Board of Boiler and Pressure Vessel Inspectors for inspection of boiler piping, observation of hydro-static testing, and for certification of completed boiler units.

K. The installation of the boilers and the specification of the trim and controls shall be in accordance with ASME Standard CSD-1, Controls and Safety Devices for automatically fired boilers, and the Code of Maryland Regulations, Title 09, Subtitle 12, Chapter 01, Board of Boiler Rules. The Contractor shall arrange for the inspection of the boiler installation by the County’s insurance inspector and by the Maryland State Boiler Inspector. The Contractor shall present the Maryland State Boiler Inspector’s Certificate of Compliance to the County upon completion of the boiler installation. At the same time that the Maryland State Boiler Inspector is notified of a boiler installation ore replacement, the Contractor shall complete a Maryland Department of the Environment, Request for Coverage: Air Quality Genera Permit to Construct Small Fuel Burning (Boiler / Heater) Equipment form and pay the application fee, for all gaseous fuel burning equipment that has a maximum heat input of 1 million BTUH or greater.

L. Provide two (2) year parts and labor warranty from date of boiler start-up.

3.3 FLUE VENTING FOR BOILERS

A. Illustrated installation manuals shall be supplied to the installer and shall be available for downloading from the manufacturer’s website.

B. All components shall be installed in strict compliance with the manufacturer's instructions and all pertinent local, regional, national, and international building and mechanical codes and regulations.

END OF SECTION 23 52 23

SECTION 23 64 00

AIR COOLED CHILLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Extent of air cooled chillers work required by this Section is indicated on drawings and schedules, by requirements of this Section and all other Division-23 Sections.

B. Types: Types of chillers specified in this Section include the following:

1. Outdoor air-cooled chillers

C. Other Divisions: Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Experience: At the time of submission of the bid or proposal, the chiller model proposed must have been a catalogued model for a minimum of two (2) years.

B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Construct and install air cooled chillers in accordance with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

C. American Society of Mechanical Engineers (ASME): Construct and test condenser and chillers in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels."

D. National Electrical Manufacturers Association (NEMA): Provide motors for air cooled chillers which are in compliance with NEMA MG 1, "Motors and Generators."

E. Underwriters Laboratories, Inc. (UL): Provide air cooled chillers which are UL listed and have UL label affixed, and are constructed in accordance with UL 465, "Central Cooling Air Conditioners."

F. Chiller shall conform to ANSI/ARI 550/590-98 and ANSI/ASHRAE 90.1, latest edition.

G. Commissioning Tests: Chillers shall meet commissioning requirements of paragraphs in Part 3 of this Section.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model, weights (shipping, installed, and operating), furnished specialties, accessories, installation, and start-up instructions.

B. Shop Drawings: Submit manufacturer's shop drawings indicating dimensions, weight loadings, required clearances, methods of assembly of components, and location and size of each field-connection.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power wiring to the units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between factory-installed and field-installed wiring.

D. Maintenance Data: Submit maintenance data and parts list for each air cooled chiller.

1.4 DELIVERY, STORAGE AND HANDLING

A. Handling: Handle air cooled chillers and components carefully to prevent damage, denting and scoring. Do not install damaged air cooled chillers or components; replace with new.

B. Storage: Store air cooled chillers and components in a clean place. Protect from dirt, water, construction debris, and physical damage.

C. Rigging: Comply with manufacturer's rigging and installation instructions.

D. Site Access: Verify site access limitations before delivery to the site.

PART 2 - PRODUCTS

2.1 AIR-COOLED CHILLERS

A. Acceptable manufacturers

1. Daikin Applied
2. Trane
3. York
4. Carrier

B. Unit description

1. Provide and install as shown on the plans factory-assembled, factory-charged air-cooled scroll compressor packaged chillers in the quantity specified. Each chiller shall consist of hermetic tandem or triple scroll compressor sets, direct expansion, shell-and-tube evaporator air-cooled condenser section, microprocessor-based control system and all components necessary for controlled unit operation.
2. Each packaged chiller shall be factory run-tested with water to verify full-load operation. Operating controls and refrigerant charge shall be verified for proper operation and optimum performance. Any deviation shall be remedied prior to shipment and the unit retested if necessary to confirm repairs or adjustments.

C. Design requirements

1. General: Provide a complete scroll compressor packaged chiller as specified herein and as shown on the drawings. The unit shall be in

accordance with the standards referenced in section 1.02 and any local codes in effect.

2. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum percentage of full load (without hot gas bypass) of 25% for units 130 tons and less and 17% for units over 130 tons. Performance shall be in accordance with AHRI Standard 550/590.
3. Acoustics: Sound pressure levels for the unit shall not exceed the following specified levels. All manufacturers shall provide the necessary sound treatment (parts and labor) to meet these levels if required. Sound data shall be provided with the quotation. Test shall be in accordance with AHRI Standard 370.

D. Chiller components

1. Compressor

a. The compressors shall be sealed hermetic, scroll type with crankcase oil heater and suction strainer. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads. The 20 – 40 ton compressors shall be equipped with an internal module providing compressor protection and communication capability.

2. Evaporator

a. The evaporator shall be direct expansion, U-tube type with water flowing in the baffled shell side and refrigerant flowing through the tubes. Two independent refrigerant circuits within the evaporator serve the unit's dual refrigerant circuits.

1) The evaporator shall have a carbon steel shell and seamless high efficiency copper tubes roller-expanded into a carbon steel tube sheet. The top and bottom of the evaporator shall have 1/2" (10mm) vent and drain plugs.
2) The evaporator shall have an electric resistance immersion heater and be insulated with 3/4" (19mm) thick vinyl nitrate polymer sheet insulation and have a K-factor of at least 0.28 at 75°F (23°C) protecting against water freeze-up at ambient air temperatures to -20°F (-29°C). A fluid thermostat shall control the heater.
3) The water side working pressure shall be 152 psig (1048 kPa). Each evaporator shall be designed, constructed, inspected, and stamped according to the requirements of the ASME Boiler and Pressure Vessel Code.

3. Condenser

a. The condenser coils shall consist of 3/8 inch (10mm) seamless copper tubes mechanically bonded into plate type fins. The fins shall have full drawn collars to completely cover the tubes. A subcooling coil shall be an integral part of the main condenser coil.

1) Condenser fans shall be galvalume blade, propeller type arranged for vertical air discharge and individually driven by direct drive fan motors. Each fan shall be in its own compartment to eliminate cross flow of condenser air during fan cycling and shall be equipped with a heavy-gauge vinyl coated fan guard.
2) Fan motors shall be weather protected, three-phase, direct-drive, 1140 rpm, TEAO type with permanently lubricated ball bearings and inherent overload protection. External coils surfaces shall have wire mesh protective guards.

b. Condenser coils shall be rippled aluminum fins.

4. Refrigerant Circuit

a. Each of the two refrigerant circuits shall include a replaceable-core refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), thermal expansion valve, and insulated suction line.

5. Construction

a. Unit casing and all structural members and rails shall be fabricated of steel and painted to meet ASTM B117, 500-hour salt spray test.
b. Upper condenser coil section of unit shall have protective, 12 GA, PVC-coated, wire grille guards.

6. Control System

a. A centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Power and starting components shall include factory circuit breaker of fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and two power blocks (one per circuit) for connection to remote, contractor supplied disconnect switches. Hinged access doors shall be lockable. Barrier panels or separate enclosures are required to protect against accidental contact with line voltage when accessing the control system.
b. Shall include standard multi-point power blocks.

7. Unit Controller

a. An advanced DDC microprocessor unit controller with a 4-line by 20-character liquid crystal display provides the operating and protection functions. The controller shall take pre-emptive limiting action in case of high discharge pressure or low evaporator pressure. The controller shall contain the following features as a minimum:
b. Equipment Protection

1) The unit shall be protected in two ways: (1) by alarms that shut the unit down and require manual reset to

restore unit operation and (2) by limit alarms that reduce unit operation in response to some out-of-limit condition. Shut down alarms shall activate an alarm signal.

c. Shutdown Alarms

1) No evaporator water flow (auto-restart)
2) Sensor failures
3) Low evaporator pressure
4) Evaporator freeze protection
5) High condenser pressure
6) Outside ambient temperature (auto-restart)
7) Motor protection system
8) Phase voltage protection (Optional)

d. Limit Alarms

1) Condenser pressure stage down, unloads unit at high discharge pressures.
2) Low ambient lockout, shuts off unit at low ambient temperatures.
3) Low evaporator pressure hold, holds stage #1 until pressure rises.
4) Low evaporator pressure unload, shuts off one compressor.

e. Unit Enable Selection

1) Enables unit operation from either local keypad, digital input, or BAS

f. Unit Mode Selection

1) Selects standard cooling, ice, glycol, or test operation mode

g. Analog Inputs:

1) Reset of leaving water temperature, 4-20 mA
2) Current Limit

h. Digital Inputs

1) Unit off switch
2) Remote start/stop
3) Flow switch
4) Ice mode switch, converts operation and setpoints for ice production
5) Motor protection

i. Digital Outputs

1) Shutdown alarm; field wired, activates on an alarm condition, off when alarm is cleared
2) Evaporator pump; field wired, starts pump when unit is set to start

j. Condenser fan control - The unit controller shall provide control of condenser fans based on compressor discharge pressure.

k. Building Automation System (BAS) Interface

1) Factory mounted DDC controller(s) shall support operation on a BACnet®, Modbus® or LONMARK ® network via one of the data link / physical layers listed below as specified by the successful Building Automation System (BAS) supplier.
2) BACnet MS/TP master (Clause 9)
3) BACnet IP, (Annex J)
4) BACnet ISO 8802-3, (Ethernet)
5) LONMARK FTT-10A. The unit controller shall be LONMARK® certified.
6) The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.
7) For chillers communicating over a LONMARK network, the corresponding LONMARK eXternal Interface File (XIF) shall be provided with the chiller submittal data.
8) All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

E. Options and accessories

1. The following options are to be included:

a. The following accessories, if selected, are to be included:

1) Evaporator inlet strainer, 40-mesh with extension pipe and Victaulic couplings
2) Spring vibration isolators for field installation
3) Rubber-in-shear vibration isolators for field installation
4) Chilled water flow switch to be field mounted in the chilled water line and field wired to terminals in the control panel
5) Field-mounted, paddle type, chilled water flow switch field wired to the control panel

F. Warranty: The manufacturer shall provide a five (5) year parts and labor warranty for the entire chiller unit (five years from date of start-up).

2.2 SOUND CONTROL SYSTEM

A. Refrigerant Blanket Insulation:

1. The Contractor shall provide removable blanket insulation with Velcro

flaps and finished surface mass of 3 lbs. per sq. ft., to cover compressors and extended components for the specified chiller. Complete 100% coverage of all compressors, discharge pipes, oil separators and suction lines is required.

2. The removable sound covers shall be constructed with a silicone-fiberglass cloth outer jacket, a loaded vinyl barrier septum, fiberglass needle mat (11 lbs./ft.3 density), and a silicone-fiberglass cloth inner jacket. The covers shall be connected together by means of clothe straps with “D” rings and Velcro fasteners. The inner and outer jackets shall protect against UV rays, oil and water. Stainless steel wire tie fastening assemblies are not acceptable.
3. Sound attenuation blankets shall provide an average reduction of 6 to 8 dBA at four (4) feet from the sound source.
4. Refrigerant blanket insulation system shall be Hush Cover HC 500S-1 as manufactured by BRD Noise and Vibration Control, Inc. or equivalent. OEM Factory Acoustical Packages by the chiller manufacturer are not acceptable.

B. Acoustical Discharge Plenum:

1. The Contractor shall provide metal acoustical panels to surround the condenser fans on the specified air cooled chiller. Metal acoustical panels shall be pre-fabricated, sectional, all metal-clad, modular and designed for easy and accurate assembly and disassembly. The panels shall be independently supported with grade anchored structural steel frame. The support system shall be PE stamped and coordinated with chiller manufacturer clearances.
2. The metal acoustical panels shall be all galvanized steel and constructed with an 18 gauge solid galvanized steel outer shell, acoustical glass fiber insulation fill, and a 22 gauge perforated galvanized inner shell. The panels and components shall not be susceptible to damage due to extended exposure to vibration, air temperature, UV rays or humidity with passage of time.
3. Discharge plenum system shall be Hush Guard HGU-200 as manufactured by BRD Noise and Vibration Control, Inc. or equivalent.

C. Perimeter Chiller Enclosure:

1. The Contractor shall provide a perimeter chiller enclosure. Quilted acoustical curtain panels shall be pre-fabricated, sectional, modular and designed for easy and accurate assembly and disassembly. The acoustical curtain panels and components shall be an open top barrier enclosure designed to completely surround the chiller on all sides and shall maintain allowable airflow distances as recommended by the chiller manufacturer. The curtain system shall come complete with acoustical curtain panels and all necessary mounting hardware. The curtain panels shall be attached to a galvanized tube steel framework supplied and installed by the acoustical company including concrete footers at post locations. A double access gate shall be located so as to facilitate future bundle pulls.
2. The acoustical curtain panels shall be constructed with a 1 lb. per sq. ft. reinforced barium loaded vinyl barrier outer facing, nominal 1” thick acoustical glass fiber insulation fill, and a vinyl coated polyester inner facing all quilted together with Gore Tenera thread. The panels and components shall not be susceptible to damage due to extended exposure to vibration, air temperature, UV rays or humidity with passage

of time. Exterior grade Velcro shall be used.

3. Perimeter chiller enclosure shall be Hush Flex EBAC-110R-P as manufactured by BRD Noise and Vibration Control, Inc. or equivalent.

D. Acoustical Performance:

1. The sound control systems shall reduce the chiller noise to a level of maximum 50 dBA at the nearest residential property line as required by the Title 26 COMAR State of Maryland noise ordinance.
2. Acoustical readings shall be provided after completed installation. Readings shall be conducted by a qualified acoustical consultant.

E. All sound control systems shall not void chiller manufacturer's warranty nor shall the system reduce or inhibit the chiller performance in any way.

PART 3 - EXECUTION

3.1 INSTALLATION OF AIR COOLED CHILLERS

A. General: Install air cooled chillers in accordance with manufacturer's installation instructions.

B. Support: Install on continuous steel frame (by others) around the chiller perimeter base, suitable to support the weight and forces associated with the chiller operation. Isolate steel frame from structural steel support framing through spring isolators. Provide spring isolators suitable for chiller installation with 1-1/2" (40 mm) deflection as needed to effectively isolate the chiller from the support structures.

C. Electrical Wiring: Install electrical devices furnished by manufacturer in conformance with the requirements of Division-26.

D. Controls: Coordinate field-installed automatic temperature controls with Division-23 section "Automatic Control Systems."

E. Start-up: Provide the services of the manufacturer's factory-trained service representative to start-up all air cooled chillers. Start-up by any organization other than the manufacturer is unacceptable.

F. Field Tests: Test controls and chiller operation. Replace damaged or malfunctioning controls and equipment. Field tests during chiller installation and start-up tests shall not be considered as fulfilling requirements of commissioning tests.

G. Piping: If multiple evaporators are provided, Contractor shall provide additional balance valves, metering ports, gages, etc. to ensure that flow can be properly balanced to each evaporator.

H. Inlet Strainer: Provide a 40 mesh strainer (or otherwise as recommended by the unit manufacturer) at the chilled water inlet to the evaporator. Strainer shall be installed within ten (10) feet of the evaporator inlet.

I. Refrigerant Pressure Relief: Refrigerant pressure relief piping shall be extended, where required, to a discharge point that is a minimum of twenty feet from any building opening (i.e. windows, ventilation openings, doors, etc.)

3.2 COMMISSIONING, TESTING AND VERIFICATION

A. Preparation: Before the scheduled commissioning tests, the Contractor and/or the manufacturer's representative shall have prepared the chillers in accordance with the recommendations of the manufacturer for start-up and operations.

B. Operational Control Test:

1. Demonstrate proper functioning of the entire operational control of the chillers. Included in the verifications, but not limited to, are oil pumps, liquid line solenoid valves, crankcase heaters, thermal expansion valves, chilled water and condenser water flow switches, and adjustable temperature controllers.
2. The chillers must demonstrate stable operation without excess vibration and noise. Each step of the multi-step control (cylinder unloading and/or compressor staging) must be verified.
3. Demonstrate proper operation of remote control of starting, stopping and resetting of the unit.
4. Demonstrate proper operation of electrical heating system for evaporator.
5. Demonstrate proper operation of head pressure control for air cooled chillers.

C. Safety Control Tests:

1. Demonstrate proper functioning of all safety cutouts.
2. Demonstrate that manual resetting is required to restart compressors for all safety cutouts.
3. Demonstrate proper operation of interlocking between chillers and chilled water pumps.
4. Variables to activate safety control actions may be simulated.
5. All safety control tests must be verified by electric signals at the compressor motor starters or actual stopping of the compressors.

D. Running and Warning Indicators Test:

1. Demonstrate proper functioning of all indicating lights (where applicable).
2. Testing of running and warning indicators (where applicable) may be performed concurrently with safety control tests.

3.3 TRAINING OF PERSONNEL

A. Training: Provide the services of the manufacturer's technical representative for one 8-hour day to instruct personnel in the operation and maintenance of air cooled chillers. Schedule training, providing at least seven days' notice.

END OF SECTION 23 64 00

SECTION 23 73 13

AIR HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Extent of air handling unit work required by this Section is indicated on the drawings, by requirements of this Section, and all other Division-23 Sections.

B. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide air handling units that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products. Units shall not be fabricated by the Contractor.

B. Certifications: Provide certified ratings of units based on tests performed in accordance with ARI 430.

C. Codes and Standards: Provide air handling units conforming to the following:

1. Air Movement and Control Association, Inc. (AMCA): Comply with applicable AMCA including:

a. 210 Laboratory Methods of Testing Fans for Rating Purposes
b. 500 Test Method for Louvers, Dampers, and Shutters

2. Air-Conditioning and Refrigeration Institute (ARI): Comply with applicable ARI including the following:

a. 410 Forced-Circulation Air-Cooling and Air-Heating Coils
b. 430 Central-Station Air-Handling Units

3. REFERENCES

a. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
b. AMCA 99 - Standards Handbook.
c. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
d. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
e. AMCA 500 - Test Methods for Louver, Dampers, and Shutters.
f. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
g. AHRI 430 - Central-Station Air-Handling Units.
h. AHRI 435 - Application of Central-Station Air-Handling Units.
i. ASTMB117 - Standard Practice for Operating Salt Spray Apparatus.
j. NEMA MG1 - Motors and Generators.
k. NFPA 70 - National Electrical Code.
l. SMACNA - HVAC Duct Construction Standards - Metal and

Flexible.

m. UL 723 - Test for Surface Burning Characteristics of Building Materials.
n. UL 900 - Test Performance of Air Filter Units.
o. UL 1995 - Standard for Heating and Cooling Equipment.
p. UL 94 - Test for Flammability of Plastic Materials for Parts in Devices and Appliances.
q. IBC 2000, 2003 - International Building Code.
r. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
s. NFPA 5000 - Building Construction and Safety Code.
t. ASHRAE 90.1 Energy Code.
u. AHRI Standard 1060 - Rating Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.
v. GSA 2003 Facilities Standard - 5.9 HVAC Systems and Components.

4. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): Construct and install refrigerant coils in accordance with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
5. National Electrical Manufacturers Association (NEMA): Except for motors, provide electrical components required as part of air handling units, which comply with NEMA Standards.
6. National Fire Protection Association (NFPA): Provide air handling unit internal insulation having flame spread rating not over 25 and smoke developed rating no higher than 50; and complying with NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems." Comply with NFPA 70, "National Electrical Code," as applicable for installation and electrical connections of ancillary electrical components of air handling units.
7. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA): Comply with applicable SMACNA standards including "HVAC Duct Construction Standards - Metal and Flexible."
8. Underwriters Laboratories, Inc. (UL): Except for motors, provide electrical components required as part of air handling units, which have been listed and labeled by UL.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air handling units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, and finishes of materials, and installation instructions.

B. Shop Drawings: Submit shop drawings showing unit dimensions, weight loadings, required clearances, field connection details and methods of support. Draw to a scale of one half inch to one foot (13 mm to 300 mm), using same sheet size as Contract Drawings. Include field fabricated mixing boxes, dampers and duct connections.

C. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in operating and maintenance manuals.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver air handling units with factory-installed shipping skids and lifting lugs; pack small components in factory-fabricated protective containers.

B. Handling: Handle air handling units carefully to avoid damage to components, enclosures, and finish. Do not install damaged components; replace and return damaged components to air handling unit manufacturer.

C. Storage: Store air handling units in clean dry place and protect from weather and construction traffic.

D. Unloading: Comply with manufacturer's rigging and installation instructions for unloading air handling units, and moving them to final locations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following:

1. Daikin
2. Trane
3. JCI/York
4. Temtrol

2.2 INDOOR AIR HANDLING UNITS

A. General description:

1. Configuration: Fabricate as detailed on drawings.
2. Performance: Conform to AHRI 430. See schedules on prints. (NOTE: above does not apply to fan array)
3. Acoustics: Sound power levels (dB) for the unit shall not exceed the specified levels shown on the unit schedule. The manufacturer shall provide the necessary sound treatment to meet these levels if required.

B. Unit construction:

1. Fabricate unit with heavy gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.
2. Panels and access doors shall be constructed as a 2-inch nominal thick; thermal broke double wall assembly, injected with foam insulation with an R-value of not less than R-13.

a. The inner liner shall be constructed of G90 galvanized steel, except liner from cooling coil to fans shall be stainless steel.
b. The outer panel shall be constructed of G90 galvanized steel.
c. The floor plate shall be constructed as specified for the inner liner.
d. Unit will be furnished with solid inner liners.

3. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 5 inches of positive or 6 inches of negative static pressure. Deflection shall be measured at the panel midpoint.
4. The casing leakage rate shall not exceed .5 cfm per square foot of cabinet area at 5 inches of positive static pressure or 6 inches of negative static pressure (.0025 m3/s per square meter of cabinet area at 1.24 kPa static pressure).
5. Module to module field assembly shall be accomplished with an overlapping, full perimeter internal splice joint that is sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.
6. Access doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and full size handle assembly. Access doors shall swing outward for unit sections under negative pressure. Access doors on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.
7. A 8-inch formed G60 galvanized steel base rail shall be provided by the unit manufacturer for structural rigidity and condensate trapping.. The base rail shall be constructed with 12-gauge nominal for unit sizes 003 - 035 and 10-gauge nominal for unit sizes 040 - 090. The following calculation shall determine the required height of the baserail to allow for adequate drainage. Use the largest pressure to determine base rail height. [(Negative)(Positive) static pressure (in)] (2) + 4" = required baserail height. Should the unit baserail not be factory supplied at this height, the contractor is required to supply a concrete housekeeping pad to make up the difference.

C. A round window inspection port shall be provided on unit section(s) as indicated on unit schedule and drawings.

D. Construct drain pans from stainless steel with cross break and double sloping pitch to drain connection. Provide drain pans under cooling coil section. Drain connection centerline shall be a minimum of 3'' above the base rail to aid in proper condensate trapping. Drain connections that protrude from the base rail are not acceptable. There must be a full 2'' thickness of insulation under drain pan.

E. Fan assemblies:

1. Energy Recovery Ventilation Unit (ERV-1) Acceptable fan assembly shall be a double width, double inlet, class II, belt-drive type housed airfoil fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes and at all bearing supports. Copper lubrication lines shall be provided and extend from the bearings and attached with grease fittings to the fan base assembly near access door. If not supplied at the factory, contractor shall mount copper lube lines in the field. Fan and motor shall be mounted internally on a steel base. Provide access to motor, drive, and bearings through hinged access door.
2. Air Handling Unit (AHU-1 and AHU-2): Acceptable fan array assembly shall consist of a single width, single inlet, class II, direct-drive type plenum fans dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. All fan assemblies shall be dynamically balanced by the manufacturer on all

three planes.

a. Walk in access section placed downstream for motor access and shall be 4" double wall with sound absorbing insulation and perforated metal inner liner.
b. Unit shall be equipped with a manual block-off plate for mounting in the fan inlet.
c. Fan array section shall come with sound absorbing panels installed around each fan.
d. Fan array shall be equipped with piezometer rings to measure airflow. One piezometer ring shall be supplied on one fan in the fan array.

3. Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of the unit if removal is required. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on 2" deflection spring vibration type isolators inside cabinetry.
4. Fan array shall have fans individually isolated with spring isolators.

F. Bearings, shafts, and drives:

1. Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards. The bearings shall be designed for service with an L-50 life of 200,000 hours and shall be a heavy duty pillow block, self-aligning, grease-lubricated ball or spherical roller bearing type.
2. Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.
3. V-Belt drives shall be cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Fixed sheaves, matched belts, and drive rated based on motor horsepower. Minimum of 2 belts shall be provided on all fans with 10 HP motors and above. Standard drive service factor minimum shall be 1.1 S.F. for 1/4 HP – 7.5 HP, 1.3 S.F. for 10 HP and larger, calculated based on fan brake horsepower.

G. Electrical:

1. Fan motors shall be manufacturer provided and installed, Open Drip Proof, premium efficiency (meets or exceeds EPAct requirements), 1750 RPM, single speed, 460V / 60HZ / 3P. Complete electrical characteristics for each fan motor shall be as shown in schedule. Motors for VFD's shall be invertor duty rated.
2. The air handler(s) shall be ETL and ETL-Canada listed by Intertek Testing Services, Inc. Units shall conform to bi-national standard ANSI/UL Standard 1995/CSA Standard C22.2 No. 236.
3. Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclosed terminal lugs in terminal box sized to NFPA 70.
4. Manufacturer shall provide ASHRAE 90.1 Energy Efficiency equation details for individual equipment to assist Building Engineer for calculating system compliance.
5. Installing contractor shall provide GFI receptacle within 25 feet of unit to satisfy National Electrical Code requirements.
6. All electrical connection components shall be field provided and mounted as shown on project schedule.

7. Fan array section shall come equipped with motor control panel with short circuit protection complete with variable frequency drives.

   a. Fan array shall be equipped with one variable frequency drive wired to all fans in the fan array. A standby (redundant) variable frequency drive shall be provided to maintain unit operation should the lead drive fail. Refer to Division 26 for drive requirements and acceptable manufacturers. Coordinate all wiring and mounting requirements with Electrical division.

8. Motor control panel shall come equipped with a disconnect switch.

H. Cooling and heating coils:

1. Certification: Acceptable water cooling, water heating, steam, and refrigerant coils shall be certified in accordance with AHRI Standard 410 and bear the AHRI label. Coils exceeding the scope of the manufacturer's certification and/or the range of AHRI's standard rating conditions will be considered provided the manufacturer is a current member of the AHRI Forced Circulation Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with AHRI Standard 410. Manufacturer must be ISO 9002 certified.
2. Water cooling coil shall be provided. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5" beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.

   a. Headers shall consist of seamless copper tubing to assure compatibility with primary surface. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.
   b. Fins shall have a minimum thickness of 0.0075 inch aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.
   c. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins, brazed at joints.
   d. Coil connections shall be carbon steel, NPT threaded connection. Connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain fittings shall be furnished on the connections, exterior to the air handler. Vent connections provided at the highest point to assure proper venting. Drain connections shall be provided at the lowest point to insure complete drainage and prevent freeze-

up.

e. Coil casing shall be a formed channel frame of stainless steel.

3. Water heating coil shall be provided. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5" beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.

   a. Headers shall consist of seamless copper tubing to assure compatibility with primary surface. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.
   b. Fins shall have a minimum thickness of 0.0075 inch aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.
   c. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins, brazed at joints.
   d. Coil connections shall be carbon steel, threaded connection. Connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain fittings shall be furnished on the connections, exterior to the air handler. Vent connections provided at the highest point to assure proper venting. Drain connections shall be provided at the lowest point to insure complete drainage and prevent freeze-up.
   e. Coil shall be furnished as an uncased galvanized steel track to allow for thermal movement and slide into a pitched track for fluid drainage.

I. Filters:

1. Furnish combination filter section with 2-inch pleated MERV 8 flat pre-filter with microbial resistant Intersept coating and 12-inch Varicel SH cartridge 85% efficient (MERV 14) final filter. Provide side loading and removal of filters.
2. Furnish flat panel filter section with 2-inch pleated MERV 8 filter with microbial resistant Intersept coating. Provide side loading and removal of filters.
3. Filter media shall be UL 900 listed, Class I or Class II.
4. Filter Magnehelic gauge(s) shall be furnished and mounted by equipment manufacturer.

J. Additional sections:

1. Access section shall be provided for access between components.

2. [AHU-1 & 2] Mixing box section shall be provided with end outside air opening and right side return air opening with or without parallel low leak airfoil damper blades. Dampers shall be hollow core galvanized steel airfoil blades, fully gasketed and have continuous vinyl seals between damper blades in a galvanized steel frame. Dampers shall have stainless steel jamb seals along end of dampers. Connecting linkage and ABS plastic end caps shall be provided when return and outside air dampers are each sized for full airflow. Return and outside air dampers of different sizes must be driven separately. Damper Leakage: Leakage rate shall be less than two tenths of one percent leakage at 2 inches static pressure differential. Leakage rate tested in accordance with AMCA Standard 500.
3. [ERV-1] Fixed Plate air-to-air heat exchanger shall be constructed of rigid thermally bonded plates separated by aluminum spacers. Exposed folded or crimped edges are not acceptable. The exchanger corrugations shall be bonded to the flat plates with a thermal adhesive and be capable of withstanding pressure differentials of up to 15" w.g. without deforming air passages. The entire heat transfer surface shall be capable of visible inspection and cleaning. Factory personnel shall calculate fixed plate temperature and pressure drop performance.

2.3 MOTORS (TYPICAL FOR ALL AIR HANDLING UNITS)

A. See Division-23 Section, "Electrical Provisions for HVAC Equipment" for minimum motor efficiencies and other requirements.

2.4 ENERGY RECOVERY VENTILATOR (ERV) / HEAT EXCHANGER

A. Minimum of 50% total energy recovery effectiveness tested to AHRI 1060

B. 0% EATR (Cross-contamination) tested to AHRI 1060

C. Mold and Bacteria resistance tested to ISO 846a and ISO 846c with a rating of 0 for both

D. Water washable while maintaining both the energy recovery effectiveness and 0% EATR rating

E. Freeze tolerant tested to 40 freeze thaw cycles from –20°C to +20°C while maintaining both the energy recovery effectiveness and 0% EATR rating

F. Comply with UL 723 flame certification with a flame spread index that shall not be over 25 and a smoke index that shall not be over 50

G. No moving parts

H. ERV Core must be AHRI Certified

I. The ERV Core shall be manufactured by "dPoint Technologies" or an approved equal provided that all the specifications are met.

PART 3 - EXECUTION

3.1 INSTALLATION OF AIR HANDLING UNITS

A. General: Install air handling units where indicated on the drawings, in accordance with equipment manufacturer's published installation instructions.

B. Access: Provide access space around air handling units for service as indicated on the drawings, but in no case less than that recommended by the manufacturer.

C. Mounting: Mount air handling units with internal factory furnished isolators in accordance with manufacturer's instructions.

D. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections.

E. Piping Connections: Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated on the drawings. Locate freezestats and trap air handling unit drain-pan connections according to manufacturer's recommendations.

F. Duct Connections: Provide ductwork, accessories, and flexible connections as required.

G. Extend condensate drain to nearest drain. Provide trap at drain pan at least 1" (25 mm) deeper than total supply fan pressure in inches of water column. For indoor units, provide a concrete pad of adequate height to allow for proper installation of condensate drain trap above floor.

H. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

3.2 AIR HANDLING UNIT DISASSEMBLY AND REASSEMBLY

A. Where required, the air handling units shall be disassembled by the mechanical contractor, transported with rigging as required to the assigned mechanical rooms located at the building interior, and reassembled in their permanent location. The air handling unit panels, doors, coils, fan base, superstructure, etc, shall be 100% bolted construction to facilitate the disassembly and reassembly procedure. Welded construction shall not be permitted. The manufacturer shall include costs for factory authorized representative(s) to supervise the complete disassembly and reassembly of the air handling units.

B. Upon reassembly of the units, the unit manufacturer representative(s) shall inspect the installation and certify that the unit meets the manufacturer’s standards. The inspection/certification shall include, but not be limited to, the following:

1. Pulley alignment and adjustment.

2. Superstructure inspection verifying all panels and unit frame are installed to manufacturer's standards.
3. Spring isolator adjustment and certification.
4. Motor operated damper adjustment and operation verification.
5. Fan motor amperage reading with the fan operating at 60Hz.
6. Belt tension reading and adjustment.
7. Drain pan inspection.
8. Access door operation and adjustment.
9. Filter inspection.
10. Pressure test(s) of the entire unit shall be performed and the maximum allowable leakage shall be one percent (1%) at 125% times the unit operating pressure, but not less than six inches (6") w.c.

C. The owner shall be invited to be present during all testing and inspections and shall be given a minimum of one week notice (5 business days) prior to testing and certification.

D. Upon completion of the inspection and testing, the manufacturer shall provide the installing contractor and the owner a type written report indicating deficiencies found. The deficiencies shall then be corrected to the satisfaction of the manufacturer and the owner.

E. Upon completion of the inspection, testing, certification and start-up, the manufacturer shall provide the owner with a signed letter indicating that all warranties, either implied or expressed, shall remain in effect for a period of two years from the date of final approval by the manufacturer and the owner. The letter shall include the unit serial number, model number, as well as the location and address of the installed units.

3.3 TESTING

A. General: Upon completion of installation of air handling units, start-up and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning units, then retest to demonstrate compliance.

3.4 EXTRA STOCK

A. Filters: Provide one (1) extra set of filters for each air handling unit. Install new filters at completion of air handling system work, and prior to testing, adjusting, and balancing work. Do not operate fans unless filters are in place.

B. Belts: Contractor shall provide one (1) spare set of belts for each belt-driven air handling unit. Deliver to the Owner's representative and mark with the air handling unit's number.

END OF SECTION 23 73 13

SECTION 23 81 19

ENVIRONMENTAL CONTROL AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Extent of environmental control air conditioning unit work required by this Section is indicated on drawings and schedules, by requirements of this Section, and all other Division-23 Sections.

B. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Manufacturer: Provide environmental control air conditioning units that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products. Units shall not be field fabricated.

B. Certifications: Submit certified technical and test data indicating compliance with the capacities specified.

C. Codes and Standards: Provide environmental control air conditioning units conforming to the following:

1. Air-Conditioning and Refrigeration Institution (ARI): Comply with ARI 240.
2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Construct and install refrigerant coils in accordance with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
3. National Electrical Manufacturers Association (NEMA): Provide electrical components required as part of environmental control air conditioning units, which comply with NEMA Standards.
4. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code" as applicable to installation and electrical connections of ancillary electrical components of environmental control air conditioning units.
5. Underwriters Laboratories, Inc. (UL): Provide electrical components required as part of environmental control air conditioning units, which have been listed and labeled by UL.

D. Certifications: Submit certified technical and test data indicating compliance with the capacities specified.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data for air conditioning units

showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, finishes of materials, and installation instructions.

B. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts list. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals in accordance with requirements of Division-1.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver environmental control air conditioning unit with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.

B. Handling: Handle environmental control air conditioning units carefully to avoid damage to components, enclosures, and finish. Do not install damaged components. Replace damaged units with new units.

C. Storage: Store environmental control air conditioning units in a clean, dry place and protect from weather and construction traffic.

D. Unloading: Comply with manufacturer's rigging instructions for unloading air conditioning units and condensing units, and moving them to final location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work will be limited to:

1. Daikin
2. Panasonic
3. Mitsubishi

2.2 ENVIRONMENTAL CONTROL AIR CONDITIONING UNITS

A. General: Provide factory assembled air conditioning system complete with split system compact wall mounted packaged evaporator section and matching outdoor unit. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label. All wiring shall be in accordance with the National Electrical Code (NEC). The units shall be rated in accordance with ARI Standard 240 and bear the ARI label. A full charge of R-410A for 100 feet of refrigerant tubing shall be provided in the condensing unit. A dry nitrogen holding charge shall be provided in the evaporator. System SEER shall meet or exceed 1992 Federal Standards.

B. Capacities: Provide environmental control air conditioning units of capacity and type as indicated on the drawings and schedules.

C. Warranty: The units shall have a manufacturer's warranty for a period of one (1) year from date of installation. The compressor shall have a warranty of six (6) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced at the contractor's expense. Manufacturer shall have ten (10) years' experience in the U.S. market.

D. Components: Provide environmental control air conditioning units that draw air through filter and coils, and that include fans, compressors, cooling coils, reheat coils, filters, remote air cooled condensing units, motors, starters, controls, and all other components necessary for proper operation.

1. Units shall be furnished complete with remote air cooled condensing unit factory assembled and tested by manufacturers of environmental control air conditioning units.
2. For units installed above ceiling, provide a secondary drain pan with leak detection. Leak detection shall alarm at the building automation system (BAS) and shall de-energize the unit.

E. Indoor Evaporator Unit: The indoor evaporator unit shall be factory assembled and wired. The casing shall have a white finish. The evaporator fan shall be an assembly with line flow fans direct driven by a single motor. The fan shall be statically and dynamically balanced and run on permanently lubricated bearings. An adjustable guide vane shall be provided with the ability to change the air flow from horizontal to vertical. A motorized air sweep flow louver shall provide an automatic change in air flow by directing the air from side to side for uniform air distribution. Return air shall be filtered by means of an easily removable washable filter. The evaporator coil shall be of non-ferrous construction with smooth plate fins bonded to copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phoscopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. The unit electrical power shall be 208 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.

F. Control System: The control system shall consist of two (2) microprocessors interconnected by a single non polar two wire cable as supplied. Wiring shall run from indoor unit to controller direct. NO SPLICES. When running longer lengths or more than one (1) set of remote controller wires together, a double insulated, two wire cable equivalent to that provided e.g. Belden 9407 cable, is mandatory or use shielded two-wire cable. One (1) microprocessor shall be factory wired and located within the indoor unit. It shall have the capability of sensing return air temperature and indoor coil temperature; receive and process commands from the remote controller; provide emergency operation; and control the outdoor unit. The microprocessor within the wall mounted remote controller shall provide automatic cooling; display setpoint and room temperature; a 24 hour on/off timer so that automatic operation can be set on the timer at one (1) hour intervals from one to twenty-four hours; have self-diagnostic function display; check mode for memory of most recent problem; control system shall have control continued operation of the air sweep louvers; and provide on-off and system/mode function switching. Normal operation of the remote controller provides individual system control in which one (1) remote controller and one (1) indoor unit are installed in the same room. The remote controller shall have the capability of controlling up to a maximum of fifty (50) systems at a maximum developed control cable distance of 1,650 feet. The control voltage between the remote controller and the indoor unit shall be 12 volts D.C. The control voltage between the indoor unit

and the outdoor unit shall be 12 volts D.C. Both 12VDC shall be generated from the indoor unit microprocessor board. The system shall be capable of automatic restart when power is restored after power interruption. System shall include twenty (20) function self-diagnostics including total hours of compressor run time.

G. Outdoor Unit: The outdoor unit shall be completely factory assembled, piped and wired. The casing shall be fabricated of galvanized steel, bonderized and finished with baked enamel. The unit shall be furnished with one (1) direct drive, propeller type fan arranged for horizontal discharge. The motors shall have inherent protection, be of the permanently lubricated type and resiliently mounted for quiet operation. The fans shall be provided with a raised guard to prevent contact with moving parts. The compressor shall be of the high performance rotary type with crankcase heater, accumulator and internal thermal overloads. The compressor shall be mounted so as to avoid the transmission of vibration. The refrigeration system shall be equipped with high pressure switch and have the capability to operate with a maximum height difference of 100 feet and overall refrigerant tubing length of 100 feet between indoor and outdoor sections without the need for line size changes, traps or additional oil. Refrigerant flow from the condenser to be controlled by means of a capillary tube. The condenser coil shall be of non-ferrous construction with smooth plate fins bonded to copper tubing. The coil shall be protected with smooth plate fins bonded to copper tubing. The coil shall be protected with an integral metal guard. The unit shall be controlled by the microprocessor located in the indoor matching unit. A built-in, low ambient controller will allow cooling to 0 degrees F outdoor temperature. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.

H. Wind Baffle: To allow cooling operation in temperature down to zero degrees Fahrenheit, a wind baffle must be installed onto the condensing unit.

I. Electrical Wiring: Provide all electrical circuits in conformance with NFPA 70 and color coded for ease in field tracing.

J. Provide five (5) year parts and labor warranty for A/C condensing units.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL CONTROL AIR CONDITIONING UNIT INSTALLATION

A. General: Install environmental control air conditioning units where indicated on the drawings in accordance with equipment manufacturer's published installation instructions.

B. Access: Provide access space around environmental control air conditioning units for service as indicated on the drawings, but in no case less than that recommended by the manufacturer.

C. Electrical Wiring: Install electrical devices furnished by manufacturer but specified to be factory-mounted. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections.

D. Refrigerant Piping: Provide field installed refrigerant piping in accordance with Division-23 section, "Refrigerant Piping."

1. Field installed refrigerant piping shall be refrigerant grade, Type L seamless copper tubing.
2. All connections and joints shall be silver soldered or brazed.
3. Pipe sizing and installation details shown on drawings shall be verified by the manufacturer. Piping shall be installed in strict accordance with manufacturer's recommendations regarding sizing and installation details.

E. Piping Connections: Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated on the drawings.

3.2 START-UP

A. General: Start and adjust all units installed under this specification under the supervision of an authorized factory trained representative of the manufacturer of each unit. Perform operational checks to make certain that controls and safety devices and systems are operating properly. If defects or improper adjustments are found, they shall be corrected and tests repeated.

1. An operational check shall be made to demonstrate compliance with contract requirements, including but not limited to, capacity and control accuracy.
2. A report signed by each factory representative shall be submitted showing test conditions and results.

END OF SECTION 23 81 19

SECTION 23 82 00

HEATING AND COOLING TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of terminal unit work is indicated by drawings and schedules, and by requirements of this section and all other Division-23 sections.

B. Types of terminal units required for project include the following:

1. Unit heaters
2. Cabinet heaters
3. Coils
4. Convectors

C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. ARI Compliance: Provide coil ratings in accordance with ARI Standard 410 "Forced Circulation Air-Cooling and Air-Heating Coils".
2. ASHRAE Compliance: Test coils in accordance with ASHRAE Standard 33 "Methods of Testing Forced Circulation Air Cooling and Heating Coils".
3. UL Compliance: Provide electrical components for terminal units which have been listed and labeled by UL.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications for terminal units showing dimensions, capacities, ratings, performance characteristics, gages and finishes of materials, and installation instructions.

B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to terminal units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Handle terminal units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged terminal units or components; replace with new.

B. Store terminal units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with Manufacturer's rigging and installation instructions for unloading terminal units, and moving them to final location.

PART 2 - PRODUCTS

2.1 UNIT HEATERS

A. General: Provide unit heaters in locations as indicated, and of capacities, style, and having accessories as scheduled.

B. Horizontal Unit Heaters:

1. Casings: Construct of steel, phosphatized inside and out, and finished with baked enamel. Provide motor-mounted panel, minimum of 18-gauge (1.3 mm) steel. Fabricate casing to enclose coil, louvers, and fan blades. Provide louvers for 4-way air diffusion.
2. Fans: Construct of aluminum, and factory-balance. Provide fan inlet orifice, smooth, and drawn into casing back panel.

C. Vertical Unit Heaters:

1. Casings: Construct of steel, phosphatized inside and out, and finished with baked enamel. Design casing to enclose fan, motor, and coil, design fan orifice formed into discharge panel. Provide air diffusers as scheduled.
2. Fans: Construct of aluminum and factory-balance. Design so motor and fan assembly is removable through fan outlet panel.

D. Coils: Construct of plate-type aluminum fins, mechanically bonded to copper tubes. Design coil for use in steam or hot water applications.

E. Motors: Provide totally enclosed motors, with built-in overload protection, having electrical characteristics as scheduled.

2.2 CABINET HEATERS

A. General: Provide cabinet heaters having cabinet sizes and in locations as indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit chassis, coil, fanboard, fan wheels, housings, motor, and insulation.

B. Chassis: Galvanized steel wraparound structural frame with edges flanged.

C. Insulation: Faced, heavy density glass fiber.

D. Cabinet: 16-gauge (1.6 mm) removable front panel, 18-gauge (1.3 mm) top and side panels. Insulate front panel over entire coil section. Provide access door on coil connection side. Clean cabinet parts, bonderize, phosphatize, and flow-coat with baked-on primer.

E. Water Coils: Construct of 5/8" (16 mm) seamless copper tubes mechanically bonded to configurated aluminum fins. Design for 300 psi (2070 kPa) and leak test at 300 psi (2070 kPa) under water. Provide same end connections for supply and return.

F. Fans: Provide centrifugal, forward curved double width fan wheels constructed of non-corrosive, molded, fiberglass-reinforced thermo-plastic material. Construct fan scrolls of galvanized steel.

G. Motors: Provide shaded pole motors with integral thermal over-load protection, and motor cords for plug-in to junction box in unit.

H. Filters: Provide 1" (25 mm) thick throwaway type filters in fiberboard frames.

I. Accessories: Provide the following accessories as indicated and/or scheduled:

1. Wall Boxes: Provide aluminum wall boxes with integral eliminators and insect screen.
2. Recessing Flanges: Provide 18-gauge (1.3 mm) steel flanges for recessing cabinet heaters into wall or ceiling.
3. Sub-bases: Provide 18-gauge (1.3 mm) steel sub-base for vertical units, height as indicated.
4. Extended Oilers: Provide plastic motor oiler tubes extending to beneath top discharge grille.

2.3 HYDRONIC COILS

A. General: Provide coils of size and in location indicated, and of capacities and having performance data as scheduled. Certify coil capacities, pressure drops, and selection procedures in accordance with ARI 410.

B. Heating Coils:

1. Fins: Construct of continuous aluminum or copper configurated plate-fin type with full fin collars for accurate spacing and maximum fin-tube contact.
2. Tubes: Construct of copper tubing, expanded into fin collars for permanent fin-tube bond and expanded into header for permanent leaktight joint.
3. Headers: Construct of round seamless copper and hydrostatically test to 400 psi (2720 kPa) before assembly.
4. Casings: Construct of 16-gauge (1.6 mm) continuous coated galvanized steel with fins recessed into channels to minimize air bypass.
5. Testing: Proof test coils at 300 psi (2070 kPa), leak test at 200 psi (1380 kPa) under water.

C. Cooling Coils:

1. Fins: Construct of continuous aluminum or copper configurated plate-fin type with full fin collars for accurate fin spacing and maximum fin-tube contact.
2. Tubes: Construct of 5/8" (16 mm) seamless copper tubes, arranged in parallel pattern with respect to air flow.
3. Casings: Construct of 16-gauge (1.6 mm) continuous coated galvanized steel for coil heights 33" (340 mm) and smaller; 14-gauge (2 mm) for coil heights over 33" (340 mm). Provide formed end supports and top and bottom channels. Provide 16-gauge (1.6 mm) steel center tube support for coil lengths 42" (1 mm) to 96" (2.4 m), 2 or more supports for coil lengths over 96" (2400mm).
4. Air Bypass Arrestor: Provide foam sealing strip located between casing channels and fins along top and bottom.
5. U-Bends: Construct of 5/8" (16 mm) copper tubes, machine die-formed on each end to provide accurate fit for silver brazed joints.
6. Testing: Proof test water coils at 300 psi (2070 kPa) and leak test at 200 psi (1380 kPa) under water. Proof test refrigerant coils at 450 psi (3100 kPa) and leak test at 300 psi (2070 kPa) under water; clean, dehydrate, and seal with dry nitrogen charge.

2.4 CONVECTORS

A. General: Provide convectors having cabinet sizes and in locations as indicated, and of capacities, style, and having accessories as scheduled.

B. Cabinets: Minimum 16-gauge (1.6 mm) steel front and top panels, 18-gauge (1.3 mm) side panels, and 20-gauge (1.0 mm) back panels. Phosphatize and galvanize back panels, phosphatize and paint tops, sides, and fronts, with one coat of primer. Secure fronts in place with quick opening slide bolts or camlock fasteners.

1. Recessed Cabinets: one-piece front panel, with 4-side gasketed overlap.

C. Elements: Aluminum fins, ribbed steel side plates, fin tube supports and copper tubes, cast-iron headers. Factory test each element to 150 psi (1020 kPa) air pressure under water.

D. Accessories: Provide the following accessories:

1. Factory-mounted dampers
2. 1/2" (13 mm) insulation on cabinet back
3. Access doors in front for valve access

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which terminal units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNIT HEATERS

A. General: Install unit heaters as indicated, and in accordance with manufacturer's installation instructions.

B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.

C. Hang units from building substrate, not from piping. Mount as high as possible to maintain greatest headroom possible unless otherwise indicated.

D. Support units with rod-type hangers anchored to building substrate.

E. Install piping as indicated.

F. Protect units with protective covers during balance of construction.

3.3 INSTALLATION OF CABINET HEATERS

A. General: Install cabinet heaters as indicated, and in accordance with manufacturer's installation instructions.

B. Locate cabinet heaters as indicated, coordinate with other trades to assure correct recess size for recessed units.

C. Install piping as indicated.

D. Protect units with protective covers during balance of construction.

3.4 INSTALLATION OF COILS

A. General: Install coils as indicated, and in accordance with manufacturer's installation instructions.

B. Mount coils on steel supports to form banks or stacks as indicated, brace, secure to air intake chamber. Place in location to permit installation of bypass damper if required, provide steel baffles where required to prevent bypassing of air.

C. Pitch coil casings for drainage, not less than 1/8" (3 mm) toward return connections, except where drainage feature is included in coil design.

D. Provide for each bank of cooling coils, stainless steel drain pan under each coil supported off of floor of sufficient height to allow installation of condensate trap to allow drainage of condensate from pan when installed on suction side of fan.

E. Provide for each hot or chilled water coil unit, water supply, return connection, strainer, shutoff valves, automatic temperature regulating valve, balancing cocks, as indicated.

F. Provide gasketed duct access doors to provide maintainable access to the upstream side of all coils.

3.5 INSTALLATION OF CONVECTORS

A. General: Install convectors as indicated, and in accordance with manufacturer's installation instructions.

B. Locate convectors as indicated, coordinate with other trades to assure correct recess size for recessed convectors.

3.6 ELECTRICAL WIRING

A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.7 ADJUSTING AND CLEANING

A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.

B. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filter units for terminals requiring same.

END OF SECTION 23 82 00

DIVISION 26 – ELECTRICAL

SECTION 26 01 00

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Unless otherwise modified in other Sections, or on the contract drawings, which define the scope and arrangement of the electrical work to be provided, the applicable provisions of these General Requirements shall govern the furnishing of all supervision, labor, equipment, tools, services, and materials necessary to install a complete electrical system ready for continuous and successful operation. The work shall include, but not be limited to, the furnishing and installation of the following items, as applicable:

1. Electrical services, including metering facilities, meeting the requirements of and in coordination with the local electric power company. Refer to the latest edition of the local power company manuals for service details.
2. Switchboards, power and lighting panelboards, and all required overcurrent devices.
3. Power feeders, branch circuit wiring and disconnect switches for mechanical equipment.
4. Lighting and receptacle feeders and branch circuit wiring.
5. Lighting fixtures with lamps.
6. Exit and emergency lighting.
7. Fire alarm system.
8. Telephone services and associated systems, including raceways and outlets, meeting the requirements of and in coordination with the local telephone company.
9. Computer Management Information, Intercommunication, Sound, Video Cable, Master Antenna, Master Clock and Program, Security, Lightning Protection and Emergency Power Systems, including raceways, wiring and outlets, meeting the requirements of and coordination with the associated companies and the applicable sections of these specifications.

1.2 PERMITS, INSPECTION AND CERTIFICATION

A. Permits: Refer to the General Conditions of the Contract.

B. Inspections: Refer to the latest edition of the local power company manuals for service inspection requirements.

C. Certifications:

1. Certificates of final inspection and approval required by agencies or authorities having jurisdiction shall cover all electrical work.
2. All certificates of final inspection and approval shall be delivered to the Engineer prior to final acceptance of the electrical work.

1.3 CODES, STANDARDS AND REFERENCES

A. The electrical work covered under the specifications and drawings shall be performed in strict accordance with the latest adopted edition of the following codes and standards:

1. National Electrical Code (NEC), NFPA 70
2. Applicable codes and standards of the National Fire Protection Association (NFPA)
3. National Electrical Safety Code, ANSI C2
4. International Building Code (IBC)
5. All authorities having jurisdiction

B. The work covered under the specifications and drawings shall be performed using the following references as minimum standards for construction and testing:

1. American National Standard Institute (ANSI)
2. National Electrical Manufacturers' Association (NEMA)
3. Underwriter's Laboratories (UL)
4. The Occupational Safety and Health Act (OSHA)
5. InterNational Electrical Testing Association (NETA)
6. Applicable standards of the utility company and the telephone company
7. American Society of Testing Materials (ASTM)
8. Institute of Electrical and Electronic Engineers (IEEE)
9. Illuminating Engineering Society (IES)
10. Insulated Cable Engineers Association (ICEA)
11. Lightning Protection Institute (LPI)

C. Electrical construction materials shall, where a listing is normal for the particular class of material, be listed in "Electrical Construction Material List" of the Underwriter's Laboratories, Inc. (UL) and shall bear the listing label. Electrical equipment shall, where a listing is normal for the particular class of equipment, be listed in the "Electrical Appliance and Utilization Equipment List" of the Underwriter's Laboratories, Inc. (UL) and shall bear the listing label. Materials and equipment listed and labeled as "approved for the purpose" by a Nationally Recognized Testing Laboratory (NRTL), inspection agency or approved organization shall be acceptable.

1.4 CONTRACT DOCUMENTS AND REFERENCES

A. The complete set of Architectural, Structural, Civil, Mechanical, and Electrical drawings and specifications apply to this work. The Contractor shall familiarize himself with all related documents.

B. The drawings and specifications shall be followed in layout of work.

C. The Architectural drawings shall be used for all dimensional information. Do not scale from the Electrical drawings.

1.5 CLARIFICATION OF DRAWINGS

A. Should a bidder find discrepancies in or omissions from the drawings or specifications, or should he be in doubt in regard to their intent, the Contractor shall notify the Engineer before submitting bid proposal. The Engineer shall then send written instructions to all bidders.

1.6 SUBMITTALS, REVIEW AND ACCEPTANCE

A. Complete shop drawings and material lists shall be submitted by the Contractor for review by the Engineer in accordance with the requirements of the GENERAL PROVISIONS. Equipment and materials for which shop drawings are not submitted shall be provided as specified, and other manufacturers and products will not be allowed. No work shall be fabricated or ordered by the Contractor until approval has been given by the Engineer.

B. Complete shop drawings showing dimensions, materials, arrangements, and other pertinent data shall be submitted.

C. Complete lists of materials and equipment shall be submitted. Full description catalog or other data shall be submitted.

D. Shop drawings and material lists shall be submitted for, but not limited to the following:

1. Conduit
2. Wire
3. Boxes, Fittings, and Wire Troughs
4. Cabinets
5. Wiring Devices
6. Panelboards
7. Dry-Type Transformers
8. Safety Switches
9. Low Voltage Fuses
10. Enclosed Circuit Breakers
11. Lighting Fixtures and Components
12. Lighting Control Equipment
13. Switchboards
14. Metering Equipment
15. Bus Duct
16. Surface Metal Raceways
17. Multi-Outlet Assemblies
18. Floor Boxes
19. Motor Starters
20. Motor Control Centers
21. Remote Control Switches
22. Automatic Transfer Switches
23. Emergency Generator
24. Emergency Lighting Equipment
25. As elsewhere indicated on the drawings or in the specifications.

E. Submittals shall include but not be limited to the following information: Size, type, functional characteristics, compliance with standards, required service access which shall be suitable for intended location and use, electrical service connections and requirements, and deviations from Contract Document requirements.

F. Shop drawings shall include plans, elevations, sections, mounting details of component parts, point to point interconnection diagrams, elementary diagrams, single line diagrams, and any other drawings necessary to show the fabrication and connection of the complete item or system.

G. Submit shop drawings and/or diagrams for all specially fabricated items, modifications to standard items, specially designed systems where detailed design is

not shown on the contract drawings or where the proposed installation differs from that shown on the contract drawings.

H. Submittals shall include Riser Diagrams and Schematic Wiring Diagrams, complete conduit and wire requirements, outlet and junction box sizes and power requirements, for the following systems:

1. Grounding Systems
2. Fire Alarm Systems
3. Nurse Call Systems
4. Telephone System
5. As indicated elsewhere on the drawings or specifications.

I. Submit 1/4" (6 mm) or 1/2" (13 mm) scale plans showing layout of equipment in electrical and communication equipment rooms and closets, elevator machine rooms, etc., indicating sizes of equipment, dimensions, clearances, etc. based on equipment being installed.

J. Prepare and stamp each submittal in a form indicating that the documents have been contractor reviewed, are complete and are in compliance with the requirements of these contract drawings and specifications.

K. In general, catalog cuts, specification sheets, descriptive data, etc., shall be acceptable for submittal of all equipment specified by standard catalog numbers, unless otherwise noted in the construction documents.

L. Shop drawings shall be clearly legible; poor reproductions or reduced photographic copies that are not legible shall be rejected.

M. Before submission of shop drawings the Contractor shall carefully check same for proper capacity, operating characteristics, physical arrangement accessories, etc., as specified or noted on drawings. If shop drawings are submitted and indicate little or no prior checking by the Contractor, they shall be rejected.

N. Submittal Identifications:

1. Place a permanent label or title block on each submittal for identification.
2. Indicate name of firm or entity that prepared each submittal on label or title block.
3. Provide a space approximately 4 by 5 inches on label or beside title block to record contractor's review and approval markings and action taken by A/E.
4. Include the following information on label for processing and recording action taken:

    a. Project name
    b. Date
    c. Name and address of A/E
    d. Name and address of contractor
    e. Name and address of subcontractor
    f. Name and address of supplier
    g. Name of manufacturer
    h. Unique identifier, including revision number
    i. Number and title of appropriate specification section
    j. Drawing number and detail references, as appropriate
    k. Other necessary identification
    l. Example: 26 24 16-01-0

- 26 24 16 references the spec section
- 01 indicates this is the first submittal from this spec section
- 0 indicates this is the original submittal (where 1 would indicate this is the first re-submittal)

O. Submittals not in compliance with the requirements of this section will be returned without review.

P. The review of shop drawings will be general and shall not relieve the Contractor from sole responsibility for errors or omissions of any sort, nor for proper fitting and construction on work or the furnishing of materials or work required by the Contract Documents but not shown or indicated on the shop drawings. Approval shall not imply verification of required quantity of material, nor correctness of dimensions. Requests by the Owner's Representative for changes and corrections on shop drawings shall not be construed as an order for extra work under the contract.

Q. Where material or equipment is identified by proprietary name, model number and/or manufacturer, furnish the named item, or equivalent, subject to acceptance. Suitability of only the named item has been verified. Where more than one item is named, only the first named item has been verified as suitable.

R. Substituted items or items other than first named shall be equal or better in quality and performance and must be suitable for the available space, required arrangement and application. Submit any and all data necessary to determine the suitability of substituted items. Substitutions must be submitted for consideration seven (7) days prior to the original bid date. Consideration of substitutions shall be at the sole discretion of the Engineer. Substitution submittals shall include all information required in the “Submittals” sub-section of this specification section, as well as all other requirements indicated throughout the Division-26 specifications.

S. Substitutions will not be permitted for specific items of material or equipment where specifically noted.

T. Compliance Review Form: Each equipment submittal must include a Compliance Review Form formatted as follows:

1. Section 1: Certify that the submittal is in complete compliance with the plans and specifications, except for the numbered and footnoted deviations and exceptions as defined herein. Deviations or exceptions taken in a cover letter or by contradiction or omission shall not constitute a release from the requirement that the equipment be in complete compliance with the plans and specifications.
2. Section 2: Provide a detailed paragraph by paragraph annotation of the specification with an individual “C”, “D”, or “E” noted in the margin, as follows:

    a. “C” shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
    b. “D” shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.
    c. “E” shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

U. Electronic Submittals: Should the contractor elect to submit electronic shop drawings/submittals, the procedure shall be as follows:

1. Provide a transmittal with the electronic shop drawing/submittal indicating that the document was transmitted electronically. Transmittal shall also include verification of the contractor's review indicating compliance with the contract documents.
2. Sequentially number all pages on the electronic shop drawing/submittal. The total number of pages shall be reflected in the transmittal.
3. Submittal review comments shall be transmitted electronically. Large documents will be scanned with comments as necessary and returned electronically.
4. All shop drawings such as, but not limited to: coordination drawings, ductwork shop drawings, fire alarm drawings, ductbank layouts, etc. shall be submitted in hard copy, full size format.
5. Provide hard copy of the shop drawing/submittal for each of the Operations and Maintenance Manuals.
6. Failure to comply with the above will result in the submittal being returned and marked "Not Reviewed".

V. The engineer will provide a maximum of two (2) submittal reviews per equipment submittal; the initial review plus one (1) re-submittal. Should the re-submittal be returned "Not Acceptable" or "Revise and Resubmit", the contractor shall provide the exact manufacturer and model indicated in the contract documents as the basis of design.

In addition, the contractor shall accept complete responsibility for all delays resulting from the submittal review process extending beyond two (2) reviews per equipment submittal.

1.7 RECORD DOCUMENTS

A. The Contractor shall maintain a record set of electrical prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.

B. A separate set of neat, legible electrical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner's Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections

C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in electronic CADD format. One (1) set of full size prints, one (1) CD of the electronic CADD drawings (in AutoCad and pdf format), along with the red-lined marked up field set shall be delivered to the owner upon completion. If requested, the electronic CADD documents shall be up-loaded to the owner's FTP site. The final CADD documents

shall indicate in the title or revision block “RECORD DOCUMENTS” along with the date completed. The electronic format shall be compatible with the owner’s preferred version of AutoCad. Coordinate with the owner before producing the CD or up-loading to the FTP site.

D. Computer (CADD) files of electrical drawings will be made available to the Contractor upon receipt of a signed waiver (available upon request). One CD will be made available to the general contractor or construction manager for distribution to the trades.

E. Should the Contractor’s electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

1.8 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

A. Upon completion of all work, the Contractor shall thoroughly instruct the Owner's representatives in the proper operation and maintenance of all electrical equipment and systems. Instructions shall be done only after completed systems have been put into operation and tested for proper operation and performance. Instructions shall be given only by experts in the equipment or systems and shall include descriptions and demonstrations for procedures of operation, data record keeping, etc.

B. The Contractor shall demonstrate, by actual usage, the proper operation of each and all portions of the various systems to the Owner or his appointed representative. Additional instructional periods shall be provided as required elsewhere in these specifications.

C. Following completion of the Electrical Contract and prior to the instructional period and final acceptance of the contract, the Contractor shall prepare three (3) Operating and Maintenance Manuals describing the electrical systems and equipment. Data in the manuals shall include, but not be limited to, the following:

1. Test results for all testing conducted in accordance with Division-26 Section, "Inspections, Testing and Start-up".
2. List of materials and equipment with name and address of vendor.
3. List of lamps, fuses (style and ampere rating), overload heaters, and other expendable equipment and devices with type, size or ordering description with name and address of vendor.
4. Operating, maintenance, and installation instructions for all systems and components with name and address of vendor and servicing supplier.
5. A certificate of approval from the Electrical Inspector.
6. A final copy of the approved coordination study.
7. Final copies of shop drawings and submittals.
8. Manufacturer's guarantees and warranties.

D. Manuals shall be of the loose leaf type, in heavy duty binders, with a master index and dividers with plastic tabs indicating system and equipment described.

1.9 RISER PLAQUE

A. Provide a computer generated riser diagram, 24" x 36" (600 mm x 900 mm) (nominal), of the completed distribution system showing incoming services, switchboard, feeders, transformers, panelboards and related equipment. All feeders

and circuits shall be sized and all equipment identified. Drawing shall be framed with plexiglass overlay.

1.10 LEED CERTIFICATION

A. This project is required to obtain a LEED certification. The Contractor shall provide all required LEED documentation as required to achieve the construction related LEED credits.

B. The project includes both LEED Fundamental and Enhanced Commissioning. Provide all services as required for compliance with the Fundamental and Enhanced Commissioning requirements. Coordinate with the Commissioning Agent as required. Refer to the Commissioning specification sections for additional information.

1.11 GUARANTEE

A. Guarantee obligations shall be as hereinbefore specified in the GENERAL PROVISIONS of these specifications, except as follows:

1. Guarantee the complete electrical system free from all mechanical and electrical defects for a period of two (2) years beginning from the day of final acceptance of the work or beneficial occupancy by the Owner, whichever occurs first.
2. During the guarantee period, the Contractor shall be responsible for the proper adjustments of all systems, equipment and apparatus installed by him and do work necessary to insure efficient and proper functioning of the systems and equipment.
3. Upon receipt of notice from the Owner of failure of any part of the electrical installation during the guarantee period, new replacement parts shall be furnished and installed promptly at no cost.
4. Within the two (2) year warranty/guarantee period, manufacturer's recommended maintenance shall be provided by the Contractor.

1.12 DEFINITIONS

A. The following definitions apply to firestopping:

1. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.
2. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.
3. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gases and smoke.
4. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.
5. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.
6. System: Specific products and applications classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.
7. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described

as part of penetrating system in other sections and may or may not be required.

PART 2 - PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. All materials and equipment shall be new, the best of their respective kinds and suitable for the conditions and duties imposed on them. Replacement parts shall be available. A permanent service organization maintained or trained by the manufacturer shall be available for service.

B. The Contractor shall set-in place and connect all electrical equipment furnished under Division-26 and all other Divisions of the Contract.

C. Verify exact electrical service requirements for each piece of equipment receiving electrical connections. Provide proper service for each.

D. Include any and all items required by the National Electrical Code and field conditions for the proper connection and installation of each piece of equipment.

E. Products of one manufacturer shall be used where two or more items of the same kind are required.

2.2 EQUIPMENT DEVIATIONS

A. The Contractor shall be governed by the requirements of the GENERAL PROVISIONS of these specifications. After an item has been approved, no substitution will be permitted except where such substitution is considered by the Engineer to be in the best interest of the Owner.

B. The Contractor shall notify the Engineer of any changes in electrical characteristics of equipment being installed as opposed to that specified.

C. Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundations, piping, ductwork, wiring, or any other part of the mechanical, electrical, or architectural layout, all such redesign, and all new drawings, and detailing required shall, with the approval of the Engineer, be prepared by the Contractor at the Contractor's own expense.

D. Where such approved deviation requires a different quantity and arrangement of ductwork, piping, wiring, conduit, and equipment from that specified or indicated on the drawings, with the approval of the Engineer, the Contractor shall furnish and install such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.

2.3 FIRESTOPPING

A. All penetrations through fire barriers shall be firestopped with an approved material that is capable of maintaining the fire resistance rating of the barrier. All firestop sealants shall conform to ASTM E 814, ASTM E 119, UL 1479, UL 2079 CAN/ULC S115, and CAN/ULC S101.

B. Firestop material shall be latex based, intumescent caulk intended for use for all thru-penetrations with piping, ducts, cable trays, conduit, and cables.

C. When exposed to high temperatures or fires, the caulk shall expand in volume to quickly close off voids left by melting or burning construction materials. Caulk shall be applied by a standard caulk gun and remain flexible after curing.

D. Acceptable products shall be limited to Johns Manville “Firetemp-C1;” Hilti “FS-One;” or 3M “CP25WB+.” Coordinate with General Contractor such that a single manufacturer/product is utilized throughout the project for all fire and smoke stopping materials.

2.4 SMOKE STOPPING

A. All penetrations through smoke barriers, smoke partitions, or any other surface required to resist the passage of smoke shall be provided with a smoke stop sealant and/or system that has been independently tested to provide an acceptable smoke seal that will resist the passage of smoke. Smoke stop systems (including product and installation) shall conform to all applicable standards (including but not limited to ASTM, UL and NFPA), as well as all other local, state or federal requirements.

B. Acceptable manufacturers shall be limited to the manufacturers that may provide firestopping materials/systems (see paragraph 2.3 of this section). Coordinate with the General Contractor such that a single manufacturer/product is utilized throughout the project for all fire and smoke stopping materials.

PART 3 - EXECUTION

3.1 SUPERVISION AND COORDINATION

A. The Contractor shall have competent supervision on the site at all times to layout, check, coordinate and supervise the installation of all electrical work and be responsible for the accuracy thereof. He shall plan the installation of all electrical work, giving consideration to the work of other trades, to prevent interference.

B. Determine the location, size, etc. of all chases, sleeve openings, etc. required for the proper installation of the electrical work and see that such are provided. All chases, sleeves, openings, etc. shall be set prior to erection of new work to prevent delay in the progress of other work or trades.

C. Conditions and/or situations which prevent the proper installation of any equipment or item where shown on the drawings shall be called to the attention of the Engineer for instructions.

D. Equipment shall be shipped or fabricated in sections of suitable size for entering the building and being removed from the finished building in the future if necessary.

E. Fully investigate all peculiarities and space limitations for all materials and equipment.

F. Outlet, pull and junction boxes and appliances which require operation, examination, adjustment, servicing or maintenance shall be readily accessible.

G. Take all field measurements necessary for this work and assume responsibility for their accuracy.

H. Coordinate the electrical work with all sub-contractors. All work shall be so arranged that there will be no delay in the proper installation and completion of any part or parts of electrical equipment. All electrical work shall be installed in proper sequence with other trades without any unnecessary delay.

I. Make all sub-contractors, suppliers and manufacturers fully aware of all requirements of the Contract.

J. Coordinate the spacing and arrangement of lighting fixtures, diffusers, grilles and access panels in ceilings to establish a symmetrical pattern. Unless otherwise indicated, items in modular ceiling systems shall be centered in individual tiles.

K. Coordinate the rough-in of all electrical work performed under other Divisions of these specifications.

L. Drawings indicate the approximate locations of outlets, apparatus and equipment. The runs of feeders and branch circuits as shown are schematic. Final routing is governed by structural conditions and other obstructions. This does not mean that the design may be changed; it merely refers to the exact run of a raceway between given points.

M. The drawings are diagrammatic and indicate the general arrangement of the equipment, the runs of conduit and the manner of connection.

N. The architectural, structural, mechanical, as well as the electrical drawings, shall be consulted in order to be entirely familiar with conditions to be encountered and special details.

O. The Contractor shall be solely responsible for the proper arrangement of conduit.

P. The Engineer shall make all final decisions as to any conditions which require the changing of any work.

Q. The electrical contractor shall coordinate fully with the elevator inspector for locations of disconnect switches, shunt trip devices, and all associated electrical work prior to installing. Fully coordinate with the elevator contractor's installation of the elevator, lift, walkway, wheel chair lifts, hoistways, etc. prior to laying out and installing any electrical equipment. Should the electrical contractor proceed without this coordination, they do so at their own risk.

3.2 STORAGE AND PROTECTION OF EQUIPMENT AND WORK

A. All materials and equipment shall be properly and effectively protected by the Contractor during the execution of the work.

B. All electrical equipment to be used in the construction shall be properly stored and protected against the elements. All equipment shall be stored under cover, and shall

not be stored at the construction site on the ground, in mud, water, snow, rain, sleet or dust. Large diameter cables may be stored on reels outside, however, all cable ends shall be waterproofed and the reels covered with weatherproof materials. Such weatherproof materials shall be heavy-duty, securely fastened and made impervious to the elements.

C. Conventional electrical construction materials such as building wire, outlet and junction boxes, wiring devices, conduit, lighting fixtures, fittings, etc., shall be stored in construction buildings, covered trailers or portable covered warehouses. Any equipment subject to damage or corrosion from excessive moisture shall be stored in dry, heated areas. Any equipment containing plastic or material subject to damage caused by excessive heat or sunlight shall be stored to prevent such damage. This includes plastic ducts and lenses.

D. All gear and equipment, if delivered to the construction site before the building is under cover and the equipment site prepared shall be warehoused and protected. All gear and equipment shall be covered and protected from the elements and other damage and shall be stored in a clean, dry, heated atmosphere, under cover at the Contractor's expense.

E. All gear and equipment delivered to the construction site after the building is under cover shall be protected as described above and in addition shall be provided with auxiliary heat to prevent condensation damage. The gear shall also be protected against damage caused by carelessness of workmen who are installing equipment connected to or adjacent to the above electrical equipment.

F. Equipment damaged as a result of the above conditions shall be properly repaired at the Contractor's expense or shall be replaced at the Contractor's expense, if, in the opinion of the Engineer the equipment has been damaged to such an extent it cannot operate properly after repairs are made.

G. All electrical enclosures exposed to construction damages such as paint spots, spackling or plaster spatter, grout splashes, waterproofing compound, tar spots or runs and pipe covering compound splashes, shall be completely covered and protected against damage.

H. In the event leakage into the building of any foreign material or fluid occurs or may occur, the Contractor shall take all steps as described above to protect any and all equipment.

I. After connections to electrical equipment are complete and the equipment is ready for operation, all construction debris shall be removed from all enclosures. Such debris includes dust, dirt, wire clippings, tape and insulation removed in order to make connections.

3.3 CUTTING AND PATCHING

A. All cutting of walls, floors, roofs, ceilings and/or partitions for the passage of conduit, etc., and closing up of superfluous openings around them in connection with the work under this contract, including the removal of all debris caused thereby, shall be performed by the Contractor.

B. All cutting, patching and finishing shall be performed in accordance with the requirements of the respective division of the specification and shall conform to adjacent work, subject to the approval of the Engineer.

C. Any work already in place that has been disturbed in the execution of the work shall be repaired and restored in harmony with the surrounding work.

D. Do not cut structural members without approval of the Engineer.

E. Patching shall be uniform in appearance and shall match with the surrounding surface.

3.4 PENETRATION OF WATERPROOF AND FIREPROOF CONSTRUCTION

A. Coordinate the work to minimize penetration of waterproof construction including roofs, exterior walls and interior waterproof construction. Where such penetrations are necessary, provide all necessary curbs, sleeves, shields, flashings, pitch pockets, fittings and caulking to make the penetrations absolutely watertight.

B. Where waterproofing or fireproofing have been removed or damaged in the execution of the work, the Contractor shall have such damage repaired by the respective trades working on the project.

C. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.

D. Seal holes or voids made by penetrations to ensure an effective smoke barrier.

E. Slots, sleeves and other penetrations in floors, wall or other general construction shall be closed and sealed with an approved firestopping material.

F. Floor slots and openings shall be closed with 16 gauge (1.6 mm) galvanized steel sheet supported on 1-inch by 1-inch by 1/8-inch (25 mm by 25 mm by 3 mm) structural angle drilled or supported with powder-driven studs into the building structure. Firestop with a layer of firestopping material not less than 1-inch (25 mm) thick which completely fills the opening. The top surface of the firestopping material shall be approximately 1-inch (25 mm) below the finished floor slab.

G. Openings in walls shall be closed with 16 gauge (1.6 mm) galvanized steel sheet securely attached at the midpoint of the wall thickness and firestopped on both sides of the steel sheet with not less than 1/2-inch (13 mm) thick layer of non-sagging firestopping material to fully cover the opening.

H. Single or multiple pipes passing through walls and floors shall have the annulus space between pipes or between pipes and structure filled with firestopping material to provide a fire rating equal to the rating of the floors and walls being penetrated. The annulus between exposed conduit and walls or floors in finished spaces shall be filled, sealed, and painted to match adjacent surfaces.

I. In fire-rated partitions where horizontal separation of opposite-facing electrical boxes is less than 24 inches, provide UL listed firestop around electrical boxes as required to maintain fire rating of wall.

3.5 MANNER OF INSTALLATION

A. Provide equipment supports consisting of structural racks, hangers, rods, etc.

B. Equipment supports shall be designed and constructed to safely support and distribute loads evenly over building areas, and withstand stresses to which they may be subjected.

C. Coordinate the location and installation of supports and sleeves to be set in concrete.

D. Provide finish metal access doors and frames as indicated or required for access to concealed electrical equipment requiring inspection, adjustment, maintenance, manual operation, etc., or required by code.

E. In suspended metal pan, lay-in-panel, and accessible tile ceilings, the ceiling element may be used as the access panel.

F. Access doors in 1-1/2 hour fire-rated construction shall bear the Underwriter's Laboratories "B" label.

G. Floor-mounted equipment (switchboards, generators, transformers, sub-stations, motor control centers, starters, control cabinets, etc.) shall be provided with concrete foundations.

H. Concrete foundations shall be reinforced to suit the loads placed on them and shall be in strict accordance with the equipment manufacturer's recommendations. Concrete materials and methods shall be as specified in Division-3 of these specifications. The Contractor shall refer to this Division to determine specific requirements.

I. Unless otherwise indicated or required, concrete foundations shall extend 4-inches (100 mm) above the finished floor, at least 3-inches (75 mm) beyond the equipment base in all directions, shall have the top edges chamfered 1" (25 mm) and shall have the same surface finish as the adjacent and surrounding floor. Where equipment weight is such that the floor slab will support the equipment the concrete foundations shall be securely anchored to the floor slab with steel dowels. Properly prepare existing floors: remove paint or dirt, clean and scarify as necessary.

J. The Contractor shall furnish and set, with proper templates, all anchor bolts and inserts required for the proper attachment of his equipment to the concrete foundations. Anchor bolts shall be of the size and number required by the equipment and/or recommended by the equipment manufacturer and shall be in accordance with the requirements detailed on the drawings and/or specified herein. Anchor bolts shall also be compatible where applicable, with vibration isolation requirements specified for the equipment. Anchor bolts shall be of adequate size and shall engage a steel plate of adequate dimensions cast into the slab.

K. The drawings indicate the wiring method. The number of current carrying conductors per raceway or cable shall be as indicated. The number of current carrying conductors cannot exceed three (3) per raceway or cable, unless the ampacity adjustment factors of NEC Article 310 are applied.

3.6 CLEANING AND PAINTING

A. All equipment and conduit shall be thoroughly cleaned of all cutting waste from reaming and tapping. All burrs and other foreign matter shall be removed. Should any part of the system be stopped up by such refuse after the various equipment and apparatus have been accepted, the Contractor shall be required to pay for all labor

and materials required to locate and remove the obstruction, and replace and repair all work in any way disturbed thereby. All enclosures, etc., shall be cleaned of all rubbish, plaster, and other debris at the completion of the work.

B. Paint all exposed metal surfaces, except for galvanized surfaces and extruded aluminum cable and wire duct, of all electrical equipment in mechanical rooms and equipment spaces. Paint all backboards in all telephone and electrical rooms.

C. Do not paint nameplates or other elements where such application would interfere with operation or maintenance of equipment.

D. All scratches or marred areas on factory painted equipment shall be touched up to match finish.

3.7 IDENTIFICATION

A. Equipment (disconnects, panelboards, starters, relays, switches with pilot lights, pushbutton stations, etc.) shall be identified as to its function, equipment, or area served, etc. In finished areas and mechanical rooms and equipment spaces identification shall be engraved phenolic plates with approximate 3/16" (5 mm) high black letters on white background. Equipment connected to the emergency power system shall be provided with phenolic plates utilizing white letters on red background. Plates shall be attached to front of devices with stainless steel, oval head, machine screws. Panelboards and equipment cabinets shall also be identified with stenciled letters, 3/4" (19 mm) high, on inside of cabinet door, colored to contrast with background.

B. All conduits containing electrical feeders shall be identified with vinyl cloth pipe markers by W.H. Brady or Seton. Labels shall be applied whenever a conduit enters or leaves a switchboard, panelboard, or a junction or pull box, and at each side of penetrations of walls or floors. Provide individual numbers and letters to indicate feeder number and voltage.

C. All pull box and junction box covers shall be stenciled to indicate voltage, service and/or system. All stenciling shall be clear and legible from a distance of five (5) feet.

D. No embossed plastic tape markers will be permitted for use in marking equipment.

E. All underground feeders, branch circuits, ductbanks, etc. shall be identified with a continuous plastic tape equal to Allen Marking Tape. Tape shall be six inches wide, waterproof, chemically resistant, yellow marked "Caution - Buried Electrical Line Below". Tape shall be located approximately midway from grade to top of feeder.

F. Receptacle Cover Plates: Provide label on front of cover plate unless otherwise noted. Label shall indicate source panel and circuit number. Label shall be a laminated, adhesive backed, peel-off, polyester type label. Label shall be comprised of a polyester base/substrate and a clear polyester top layer/laminate. The label ink shall be printed underneath the clear polyester laminate. Label shall have black lettering on clear background. Label width shall be a nominal 0.47” (12 mm) wide. Basis of design is the TZe labeling tape by Brother Mobile Solutions, Inc. For use with the Brother P-Touch EDGE Series labeling tools.

G. All identification shall be subject to the approval of the Engineer.

3.8 EXAMINATION OF SITE

A. The Contractor shall examine the premises prior to submitting his bid and observe the conditions under which the work will be done or other circumstances which will affect the contemplated work. No allowance will be made for any work in connection with any error or negligence on the Contractor's part. No claim for extra compensation will be recognized for difficulties encountered which, in the opinion of the Owner, would have been revealed by proper examination.

3.9 ELECTRICAL DEMOLITION

A. All demolition of existing electrical equipment, conduit, wiring devices, lighting fixtures, etc. shall be performed under this section of the specification. The areas of demolition are defined on the architectural drawings and specific references are made on the electrical drawings.

B. The electrical demolition in the renovation areas indicated on the drawings shall be complete and include all electrical work in the area unless noted otherwise.

C. Existing electrical systems passing through areas of demolition to serve equipment beyond the demolition areas shall remain in service, or be suitably relocated and restored to normal operation, throughout the demolition and reconstruction of the area. The Contractor shall investigate and identify such equipment prior to demolition.

D. Provide temporary electrical service to equipment disturbed by the demolition until such time as the permanent service can be restored.

E. The local power company shall disconnect and remove all equipment and facilities that they own and/or maintain. The Contractor shall make and be responsible for all arrangements with the local power company to accomplish removal of their equipment.

F. Where conduit and wiring to remain are inadvertently damaged or disturbed, cut out and remove damaged portion and all damaged wiring from the source switchboard, panelboard or pullbox to the destination connection point. Provide new wiring of equal capacity.

G. Exposed conduit and conduit within accessible ceilings, floors and walls to be demolished shall be removed in its entirety, including all conduit, supports, junction boxes, etc. Conduit concealed within non-accessible ceilings, floors and walls abandoned in place, shall be cut flush with walls and floors, plugged, and the adjacent surface patched to match existing.

H. Wiring to be demolished shall be removed from both concealed and exposed conduit. No wiring which becomes unused as a result of the Contract shall be abandoned in place.

I. Equipment specified or indicated to be demolished, shall be removed from the project site and shall not be reused. Equipment required to be temporarily disconnected and relocated shall be carefully removed, stored, cleaned, reinstalled, reconnected and made operational.

J. All material being disposed of shall be done as required to meet the applicable environmental regulations for all local, state, and federal agencies. Examples include, but are not limited to, light fixture ballasts, fluorescent lamps, and batteries.

K. Any outages in systems shall be coordinated with the Owner. Where duration of proposed outage cannot be tolerated by the Owner, provide temporary connections as required to maintain service.

L. Disconnect abandoned outlets and remove devices and wiring back to point of use. Provide blank cover for abandoned outlets.

M. The contractor shall use care when performing selective building and site demolition. The contractor shall be responsible for damage inclusive of but not limited to: building finishes, lighting (interior and exterior), furniture, structure, site, utilities (above and below ground), mechanical, plumbing, telecommunications and electrical equipment / systems. Should any damage occur or should any remedial work be required, the contractor shall be responsible to repair and or replace the damaged item(s) to the Owner's satisfaction at no additional cost. The contractor shall be responsible for surveying (including contacting Miss Utility), photo documenting and restoring the surrounding work site(s) to the original pre-demolition condition and / or to the Owner's satisfaction upon completion of the work at no additional cost.

N. Repair adjacent construction and finishes damaged during demolition. Patch all holes left from demolished equipment. Paint surfaces exposed by demolition to match adjacent surfaces.

3.10 CONNECTIONS TO EXISTING WORK

A. When the work specified hereafter connects to any existing equipment, conduit, wiring, etc., the Contractor shall perform all necessary alterations, cutting, fitting, etc., of the existing work as may be necessary or required to make satisfactory connections between the new and existing work and shall leave the completed work in a finished and workmanlike condition, to the satisfaction of the Engineer.

B. When the work specified hereafter or under other Sections or Divisions of the contract necessitates relocation of existing equipment, conduit, wiring, etc., the Contractor shall perform all work and make all necessary changes to existing work as may be required to leave the completed work in a finished and workmanlike manner to the satisfaction of the Engineer.

C. The Contractor is cautioned that all existing electrical systems and life safety systems must remain in service during all phases of construction.

D. The Contractor shall work in close cooperation with the Owner for any temporary outages.

E. It is imperative that all interruptions of the electrical service and standby service be kept to an absolute minimum. The Contractor must submit a written request to the Owner for any and all interruptions of the electrical service or the standby service 72 hours in advance of the planned outage.

3.11 WORKMANSHIP

A. All materials and equipment shall be installed and completed in a first class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat or workmanlike appearance shall be removed and replaced when so directed by the Engineer. The removal and replacement of this work shall be done, when directed in writing by the Engineer, at the Contractor's expense.

3.12 REPAIR OF EXISTING PROPERTY

A. All work shall be carefully laid out in advance, and where cutting, channeling, chasing, trenching, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of raceways, outlet boxes, or other electrical work, this work shall be carefully done, and any damage to building, piping, equipment, or ground shall be properly repaired by skilled mechanics of the trades involved, at no additional cost to the Owner.

3.13 TEMPORARY ELECTRICAL SERVICE

A. The Contractor shall provide temporary electrical service on the site as is necessary to enable his work and the work of others on the job to proceed and to test the operation of all apparatus, devices, systems which require electrical energy.

B. The Contractor is responsible for temporary power as may be required for construction or as may be required to maintain critical operations during changeover of feeders or services. The Contractor is responsible for providing all equipment, making all arrangements, and making all connections required for temporary power.

C. The Contractor shall disconnect and remove all equipment and facilities required for temporary power at the completion of the project.

3.14 PUNCH-OUT PROCEDURES

A. Preliminary Punch-out:

1. Prior to requesting an inspection from the Owner, Engineer, or Permit Official, the General Contractor or Construction Manager (GC or CM) shall provide a preliminary punch-out of the area in question.
2. Once completed, their punch list shall be supplied to each trade for corrections and completion. The punch list shall also be provided to the Engineer for their use.
3. Upon being informed that the trade contractors have addressed all of the outstanding items, the GC / CM shall backcheck the work and update the punch list.

B. Final Punch-out:

1. Final punch-out by the engineer shall not commence until the GC or CM has exhausted their review and has signed off on all items.
2. A copy of the sign-off shall be provided to the Engineer for their record.
3. Once the above has been completed, the Engineer shall be notified that the work is substantially complete and ready for a final punch-out.

4. Depending on the size, schedule, and project complexity, punch-outs may be requested for specific areas or systems, rather than the facility as a whole. Examples of specific requests include the following:

   a. Above ceiling
   b. Mock-ups for any repetitive installation to confirm acceptance prior to continuing (labs, dorms, offices, etc.)
   c. Equipment rooms

END OF SECTION 26 01 00

SECTION 26 02 00

PROJECT CLOSEOUT - ELECTRICAL

PART 1 – GENERAL

1.1 SUMMARY

A. This section provides a summary of the primary electrical project closeout activities, however, this section does not attempt to address all project closeout requirements. Closeout activities referenced in this section include the following:

1. Testing
2. Start-up
3. Punch-out Procedures
4. Operation and Maintenance Manuals (O & M Manuals)
5. Demonstration and Training
6. Record Documents
7. Close-out Documents

B. This Section shall not supersede any other close-out section or requirements of the Contract. Refer to other Divisions of the specifications and the General Requirements of the Contract for further instructions.

PART 2 – PRODUCTS

Not Applicable

PART 3 – EXECUTION

3.1 TESTING

A. The Contractor shall perform systems and equipment inspections and tests as specified in each Division-28 and Division-26 specifications section. Particular attention shall be paid to Division-26 section “Inspections, Testing and Start-up.”

B. An independent testing firm shall perform systems and equipment inspections and tests as specified in each Division-26 section. Particular attention shall be paid to Division-26 section “Inspections, Testing and Start-up.”

3.2 START-UP

A. The Contractor shall perform start-up on each piece of electrical equipment as specified in each section of Division-26.

B. Where indicated in each section of Division-26, the services of a factory authorized and certified technician shall be required to perform the equipment start-up. Start-up by any other organization other than as required by the manufacturer is unacceptable.

C. Start-up reports shall be provided for all equipment and be included in the final O & M Manuals.

3.3 PUNCH-OUT PROCEDURES

A. Preliminary Punch-out:

1. Prior to requesting an inspection from the Owner, Engineer, or Permit Official, the General Contractor or Construction Manager (GC or CM) shall provide a preliminary punch-out of the area in question.
2. Once completed, their punch list shall be supplied to each trade for corrections and completion. The punch list shall also be provided to the Engineer for their use.
3. Upon being informed that the trade contractors have addressed all of the outstanding items, the GC / CM shall backcheck the work and update the punch list.

B. Final Punch-out:

1. Final punch-out by the engineer shall not commence until the GC or CM has exhausted their review and has signed off on all items.
2. A copy of the sign-off shall be provided to the Engineer for their record.
3. Once the above has been completed, the Engineer shall be notified that the work is substantially complete and ready for a final punch-out.
4. Depending on the size, schedule, and project complexity, punch-outs may be requested for specific areas or systems, rather than the facility as a whole. Examples of specific requests include the following:

    a. Above ceiling
    b. Mock-ups for any repetitive installation to confirm acceptance prior to continuing (labs, dorms, offices, etc.)
    c. Equipment rooms

3.4 OPERATION AND MAINTENANCE MANUALS

A. Submit Operation and Maintenance Manuals in three-ring binders with each section separated by tab dividers. Include protective plastic sleeves for any software or folded large documents submitted.

B. At a minimum, the manual shall contain the following:

1. Test results for all testing conducted in accordance with Division-26 Section, "Inspections, Testing and Start-up".
2. List of materials and equipment with name and address of vendor.
3. List of lamps, fuses (style and ampere rating), overload heaters, and other expendable equipment and devices with type, size or ordering description with name and address of vendor.
4. Operating, maintenance, and installation instructions for all systems and components with name and address of vendor and servicing supplier.
5. A certificate of approval from the Electrical Inspector.
6. A final copy of the approved coordination study.
7. Final copies of shop drawings and submittals.

8. Manufacturer's guarantees and warranties.

C. The O & M Manuals shall be submitted to the A/E for review of general conformance.

3.5 DEMONSTRATION AND TRAINING

A. Upon completion of work, instruct the owner's representative in the proper operation and maintenance of each electrical system in accordance with applicable specification sections.

B. Instructions shall be given by persons expert in the operation and maintenance of each system / equipment.

C. Prepare statement(s) for signing by Owner's representative indicating the date of completion of instructions and hours expended. Furnish copies of signed statements to the A/E.

D. Final demonstration of all electrical equipment shall be recorded in DVD compatible format. Provide DVD’s to the Owner.

3.6 RECORD DOCUMENTS

A. The Contractor shall maintain a record set of electrical prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.

B. A separate set of neat, legible electrical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner’s Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections

C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in electronic CADD format. One (1) set of full size prints, one (1) CD of the electronic CADD drawings (in AutoCad and pdf format), along with the red-lined marked up field set shall be delivered to the owner upon completion. If requested, the electronic CADD documents shall be up-loaded to the owner’s FTP site. The final CADD documents shall indicate in the title or revision block “RECORD DOCUMENTS” along with the date completed. The electronic format shall be compatible with the owner’s preferred version of AutoCad. Coordinate with the owner before producing the CD or up-loading to the FTP site.

D. Computer (CADD) files of electrical drawings will be made available to the Contractor upon receipt of a signed waiver (available upon request). One CD will be made available to the general contractor or construction manager for distribution to the trades.

E. Should the Contractor's electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

3.7 CLOSEOUT DOCUMENTS

A. Prior to Substantial Completion and /or Final Payment, the Contractor shall prepare and submit the following:

1. Final punch lists indicating completion of all items.
2. All record drawings.
3. All record specifications.
4. Operation and Maintenance Manuals.
5. Complete final cleaning.
6. Remove temporary facilities and complete site restoration.
7. Where lightning protection system work is provided, provide UL Master Label Certificate.

END OF SECTION 26 02 00

SECTION 26 05 01

INSPECTIONS, TESTING AND START-UP

PART 1 - GENERAL

1.1 DESCRIPTION

A. The intent of the inspection, testing, and check-out work specified herein is to insure that all electrical workmanship and equipment, whether Owner furnished or Contractor furnished, is installed and performs in accordance with the Contract Documents, manufacturer's instructions and all applicable codes and requirements. Also, it is intended to insure the following:

1. Equipment has not been subjected to damage during shipment or installation.
2. Equipment is in accordance with the specifications.
3. A bench mark is established for routine maintenance and troubleshooting.
4. Successful start-up without last minute interruptions and delays.
5. Each system component is installed satisfactorily and will perform its function reliably throughout the life of the plant.

B. Testing requirements in other sections of this Specification are intended to compliment and not supercede nor be superceded by this Section.

1.2 RELATED SECTIONS

A. Division-01Section - Submittals.

B. Division-01 Section - Quality Control.

C. Division-01 Section - Materials and Equipment.

D. Division-26 - Electrical Specifications.

1.3 REFERENCES

A. American National Standards Institute (ANSI)

1. ANSI C2, National Electrical Safety Code
2. ANSI Z244-1, American National Standard for Personnel Protection

B. American Society of Testing and Materials (ASTM)

C. Institute of Electrical and Electronic Engineers (IEEE)

D. Insulated Cable Engineers Association (ICEA)

E. International Electrical Testing Association (NETA)

F. National Electrical Manufacturer’s Association (NEMA)

G. National Fire Protection Association (NFPA)

1. ANSI/NFPA 70, National Electrical Code
2. ANSI/NFPA 70B, Electrical Equipment Maintenance
3. ANSI/NFPA 70E, Electrical Safety Requirements for Employee Workplaces
4. ANSI/NFPA 780, Lightning Protection Code

H. Occupational Safety and Health Administration (OSHA)

I. State and Local Codes and Ordinances

1.4 SUBMITTALS

A. Provide resumes for personnel conducting tests and evidence of the testing firm's qualifications, accreditation and experience.

B. Provide a list of test equipment to be utilized including the manufacturer’s name, model number, serial number, accuracy, and last date of calibration.

C. Provide industry standards or guide specifications used in lieu of National Standards.

D. Provide testing procedures and schedules.

1.5 TESTING FIRM

A. When an independent testing firm is utilized, the following shall apply. The testing firm shall be a competent, independent electrical equipment testing laboratory or organization. The testing firm shall not be a subsidiary, division, nor department of either the installing Contractor or the manufacturer of the equipment materials or systems being inspected and tested. The testing firm shall be a fully accredited member of the International Electrical Testing Association (NETA) and have the specialized experience and skill in the supervision and performance of all inspection and testing specified herein.

1.6 TEST INSTRUMENT CALIBRATION

A. The testing firm or contractor shall have a calibration program which assures that all applicable test instrumentation is maintained within rated accuracy.

B. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).

C. Instruments shall be calibrated in accordance with the following frequency schedule:

1. Field instruments, analog: six (6) months.
2. Field instruments, digital: twelve (12) months.
3. Laboratory instruments: 12 months.
4. Leased specialty equipment: 12 months.

D. Calibration labels shall be visible on all equipment and shall have a date of calibration and due date. Calibration records shall be available for review by the Owner.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.1 COORDINATION

A. Provide all necessary supervision and labor, materials, tools, test instruments and other equipment or services required to inspect, test, adjust, set, calibrate, functionally and operationally check all work and equipment.

B. When an independent testing firm is utilized, provide a set of contract documents to the testing firm.

C. When an independent testing firm is utilized, provide a copy of the approved short-circuit and protective device coordination study to the testing firm.

D. Provide the testing firm a set of approved submittals and shop drawings for the equipment to be tested by the testing firm.

E. Prepare procedures and schedules for all inspections, tests, settings and calibrations specified or otherwise required. The procedures must provide specific instructions for the checking and testing of each component in addition to the system functional checks. All procedures submitted shall include proposed job safety rules.

F. Provide a suitable and stable source of electrical power to each test site. The testing firm shall specify the specific power requirements. The Owner shall approve all sources of electrical power for testing.

G. Notify the Owner prior to the commencement of any testing.

3.2 INSPECTIONS AND TESTS

A. Equipment purchased by the Contractor or purchased by the Owner but installed by the Contractor shall be inspected and tested to determine its condition.

B. The inspections, tests and checks described herein shall not be considered as complete and all inclusive. Additional normal standard construction (and sometimes repetitive) checks and tests shall be provided as necessary throughout the project, prior to final acceptance by the Owner.

C. At any stage of construction and when observed, any electrical equipment or system determined to be damaged, faulty, or requiring repairs shall be reported to the Owner. Corrective action may require prior approval.

D. Perform routine insulation resistance, continuity and phase rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.

E. Provide the services of an independent testing firm to provide testing of the following systems and equipment.

1. 480 volt switchgear and switchboards

2. 480 volt metal enclosed busway
3. Dry type transformers
4. Grounding systems
5. Ground fault systems
6. 480 volt circuit breakers rated 400 amperes and greater
7. Instrument transformers
8. Metering and instrumentation
9. Generator sets

F. At the option of the Contractor, either an independent testing firm or the Contractor shall provide visual and mechanical inspections of the following systems and equipment.

1. Panelboards
2. Dry type distribution transformers (600 volt and below)
3. Low voltage wiring (600 volt and below)
4. Molded case circuit breakers rated less than 400 amperes
5. Automatic transfer switches
6. Motor control
7. Air switches (600 volt and below)
8. Lighting control system
9. Fire detection and alarm system

G. All circuit breakers and protective devices shall be set and tested at the settings specified in the approved protective device coordination study. All fuses shall be selected and installed in accordance with the approved coordination study.

H. The rotation of all motors shall be checked and corrective action shall be taken where necessary to obtain correct rotation.

I. Engagement of an independent testing firm in no way relieves the Contractor of the responsibility for the performance of the many and varied tests, checkouts, and inspections required during the various stages of construction.

3.3 CERTIFICATION

A. Provide certified test reports. Test reports shall meet the criteria specified in OSHA Regulation Part 1907, “Accreditation of Testing Laboratories”. The certification shall attest to the fact that the electrical installation has been installed and tested in accordance with the applicable National Standards or, where no National Standard exists, the applicable industry standard or guide specification for the equipment involved.

B. The following information shall be included in the test reports.

1. Description of equipment tested (manufacturer, model number, serial number).
2. Description of test and standards used.
3. Description of test equipment.
4. Test results with pass/fail criteria.
5. Conclusions and recommendations.
6. Names of personnel conducting the test.

C. When testing is provided by an independent firm, the report shall be signed by a Registered Professional Engineer.

D. Provide three (3) copies of the complete test report no later than thirty (30) days following completion of the tests.

END OF SECTION 26 05 01

SECTION 26 05 19

WIRES AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

A. The Contractor shall provide, install and terminate all wires and cables for power, lighting, signal, control and related systems rated 600 volts and less.

1.3 SUBMITTALS

A. Submit product data for electrical wires, cables and connectors.

1.4 QUALITY ASSURANCE

A. All wires, cables and connectors and the installation of wires, cables and connectors shall comply with the following standards:

1. NFPA 70 "National Electrical Code."
2. UL Standards pertaining to wires and cables:

a. UL Std 44, Rubber Insulated Wires and Cables
b. UL Std 83, Thermoplastic - Insulated Wires and Cables
c. UL Std 486A, Wire Connectors and Soldering Lugs for Use with Copper Conductors, UL Std 486B for Use with Copper or Aluminum
d. UL Std 854, Service Entrance Cable

3. Applicable NEMA Standards pertaining to wires and cables.
4. Applicable IEEE Standards pertaining to wires and cables.

B. Wires, cables and connectors shall be listed and labeled by UL.

PART 2 - PRODUCTS

2.1 WIRES AND CABLES

A. All wiring #14 and larger shall be soft drawn copper, 98 percent conductivity, 600 volt insulation, type THHN/THWN.

B. All wiring connections to lighting fixtures shall have insulation suitable for the temperatures to be encountered in accordance with the NEC.

C. All wiring #8 and larger for feeders and branch circuits shall be stranded.

D. Minimum wire sizes shall be #12 for power and lighting circuits and #14 for control circuits unless otherwise noted.

E. All wiring shall have identification markings along the outer covering denoting conductor size, type of insulation, and manufacturer's trade name. All wiring shall be color coded as follows:

PHASE	120/208 VOLTS	277/480 VOLTS
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

F. Wiring in sizes up to #8 shall have colored insulation, wiring in sizes #6 and larger shall be coded by colored tape applied no more than 6 inches (150 mm) from each termination and spanning a minimum length of 6 inches (150 mm) of insulation.

G. All emergency wiring shall be clearly identified as emergency in all outlets, fixtures, etc.

2.2 MINERAL INSULATED (MI) CABLE

A. Type MI cable shall be mineral insulated, metal sheathed cable, factory assembled, with one or more conductors insulated with highly compacted magnesium oxide insulation, sealed in a liquid-tight and gas-tight continuous copper sheath.

B. Conductors shall be of solid, high electrical conductivity copper with a cross-sectional area equivalent to AWG sizes.

C. Type MI cable shall be UL listed and labeled for two-hour fire resistance classification.

D. Fittings and terminations shall be listed and labeled for use with type MI cable.

E. Type MI cable shall be as manufactured by Pyrotenax and shall have the approval of the authority having jurisdiction.

2.3 CABLE REELS

A. Cable reels shall retrieve and store loose power cables when not in use. Cable reels shall allow power cables to be pulled out to desired length, locked, and retracted for storage when not in use. Cable locking ratchets shall prevent constant tension on the cable.

B. A collector ring and brush assembly shall transfer electrical power from the stationary base to the retractable power cable.

C. Cable reels shall utilize wound steel springs. The reels shall be designed such that less than 70 percent of the available spring turns are used to meet the cable payout specified.

D. The number and size of conductors of the cable reels shall match the branch circuit ratings indicated on the Drawings. All cable reel assemblies shall include a grounding conductor, and in no case shall the conductors be smaller than #12 AWG.

E. Cables shall be type SO extra-flexible for reeling service and consist of a minimum of 65 strands of #30 AWG copper wire. Cables shall have a neoprene oil resistant jacket. Cables shall be provided by the cable reel manufacturer. Cables shall be a minimum of 20 feet (6 m) in length.

F. Cable reels shall be of heavy-duty construction suitable for indoor or outdoor service. The cable reels shall be capable of lifting and rewinding a fully extended cable including any accessory wiring device on the end of the cable.

G. Cable reels shall be designed to permit payout and retrieval of cable at angles of 0 - 30 degrees from vertical center. Rollers shall be utilized to reduce wear on the cable jacket.

H. Cable shall be provided with NEMA 5-20R receptacles constructed from impact-resistant nylon suitable for heavy-duty service. The receptacles shall be completely insulated and shall incorporate an integral cable grip.

I. Cable reels shall be provided with junction boxes suitable for hard wiring to the branch circuit indicated on the Drawings.

J. Cables shall be provided with adjustable ball stops.

2.4 METAL CLAD (MC) CABLE

A. The use of MC cable is prohibited unless specifically noted otherwise.

B. The maximum allowable branch circuit conductor size utilizing MC cable shall be #10 AWG.

C. The following standards shall apply:

1. UL Standard 1569 for MC Cable
2. UL Standard 83 for Thermoplastic Insulated Wires
3. Federal Specification J-C-30B
4. NEC Article 330

D. Each circuit conductor and the grounding conductor shall be solid, uncoated copper insulated with PVC and jacketed with nylon complying with the physical and electrical requirements of UL Standard 83 for type THHN.

E. All cables shall contain a green THHN grounding conductor.

F. The cables shall be rated 194°F (90°C) and 600 volts.

G. Cables for use in plenum ceilings shall comply with NEC 300-22 (C).

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring shall not be installed until building is under roof.

B. All wiring for lighting and power circuits shall be sized as follows unless otherwise indicated:

120 Volt Branch Circuit Length	Wire Size
0-75' (0-22.5 m)...	#12
75-150' (22.5-45 m)	#10
Over 150' (Over 45 m)	# 8

277 Volt Branch Circuit Length	Wire Size
0-200' (0-60 m)	#12
Over 200' (Over 60 m)	#10

In accordance with the above where the size of branch circuit conductors is increased by the minimum required by the NEC for the branch circuit rating, it is the Contractor's responsibility to insure that the termination provisions of all equipment connected to such circuits are listed as suitable for the conductor sizes involved.

C. Emergency lighting and exit sign circuits shall not be installed in raceway, boxes, etc. with other wiring systems, except at lighting fixtures.

D. Wire pulling compounds shall be polywater or equivalent. The use of oils and greases shall not be permitted.

E. All field-installed control wire and cable terminating in motor control centers, panelboards, junction boxes, etc. shall be identified with pre-stamped tubular type markers or pressure sensitive linen labels covered with clear heat shrinkable tubing. Labels shall indicate circuit numbers, terminal numbers, etc. of each conductor. The identification labels shall be as manufactured by the W.H. Brady Company, Tyton, or equivalent.

F. No conductors shall be installed in raceways before the raceway system is properly installed and all work on the building which is liable to injure the conductors has been completed. Immediately before installing the conductors, the raceway, fittings and boxes shall be thoroughly cleaned and dried.

G. The sharing of the neutral conductor for branch circuits is prohibited unless specifically called for on the drawings.

H. Conductors shall be continuous between cabinets, outlets and/or junction boxes; no splices or taps shall be made within the raceway itself. Under no circumstances shall feeder conductors be spliced.

I. At least six inches (150 mm) of free conductors shall be left at each outlet, cabinet, junction box, etc. where they are connected or spliced.

J. Wiring devices shall not be used as splices; pigtails (line, neutral and grounding) from circuit wiring shall be provided to allow removal of the device without opening the circuit.

K. Wiring in cabinets shall be neatly laced or tied.

L. Cable reels shall be secured to the overhead structure. Ceiling support wires and framing shall not be used to support cable reels.

M. Cable reel ball stops shall be adjusted to provide a maximum retracted height for receptacles at 78 inches (1950 mm) above the finished floor.

3.2 MINERAL INSULATED (MI) CABLE INSTALLATION

A. MI cable shall be supported using steel support methods as specifically recommended by the manufacturer. Provide all MI termination/connector kits.

B. Cable shall be clipped directly to walls, beams or ceilings using clips or straps supplied by the manufacturer. Fire rated circuits must be secured to a two-hour fire rated surface using supports not to exceed 3 feet (900 mm) on center. Spacing of supports for non-fire rated circuits shall not exceed 6 feet (1800 mm) on center.

C. Exposed runs of cables shall be installed parallel to building lines to present a neat appearance. When subject to potentially damaging abuse, cables should be protected by angle iron, channel or short pieces of conduit.

D. Cables embedded in concrete shall be protected against puncture damage and have an overall protection of a PVC jacket. Where cables emerge from a slab, protection against sheer damage shall be provided by means of a rigid steel conduit stub-up. Conduit stub-up shall extend from 18 inches (450 mm) below finished grade to 6 feet (1800 mm) above finished grade.

E. Minimum bend radius shall be as recommended by the manufacturer but in no case shall be less than five (5) times the cable diameter.

F. Multiple runs of single conductor cables shall be run close together with sheaths touching throughout the length of the run. Single conductor cables in parallel shall be "phased out" in groups and the groups spaced at least two (2) cable diameters apart. Parallel cables shall be the same length, have the same conductor material, be the same size in circular mil area, have the same insulation type and be terminated in the same manner.

G. The cables shall be terminated with glands and seals supplied by the manufacturer and approved for the application and installed according to the manufacturer's recommendations. Ordinary locations and areas classified as Division 2 Hazardous shall use standard termination and sealing compound. Areas classified as Division 1 Hazardous shall use hazardous location terminations and sealing compound.

H. Stripping tools, pot wrenches, crimping and compressing tools designed for the purpose shall be used to prepare the cable and install the glands and seal assemblies.

I. Upon completion of the terminations, the insulation resistance of the cable shall be checked with a 500 volt insulation tester and a resistance value achieved which is in accordance with the manufacturer’s specifications.

J. Fire rated joints and splices shall be provided by the manufacturer.

K. A brass plate 1/4" (6 mm) minimum thickness shall be used for terminating single conductor cables carrying currents in excess of 200 amperes.

3.3 METAL CLAD (MC) CABLE INSTALLATION

A. The use of MC cable is prohibited unless specifically noted otherwise.

B. MC cable shall not be used within electrical rooms, mechanical rooms, janitor's closets, or in any exposed locations.

C. MC cable shall not be used for feeders or branch circuit homeruns.

D. MC cable shall be clipped directly to walls using clips or straps supplied by the manufacturer. Spacing of supports for non-fire rated circuits shall not exceed 6 feet (1800 mm) on center.

E. Minimum bend radius shall be as recommended by the manufacturer.

F. MC cable may be used for lighting whips; maximum 6 foot length, in accessible locations.

3.4 TESTING

A. Feeders shall be checked using a megohm tester to determine the insulation resistance levels prior to energizing.

B. Branch circuits shall be tested to ensure electrical continuity and to ensure the system is free of short-circuits.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies general grounding and bonding requirements for all electrical installations.

1.2 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, “Basic Electrical Materials and Methods”, apply to this Section.

1.3 SUMMARY

A. All systems, circuits and equipment shall be grounded and bonded in accordance with Article 250 of the National Electrical Code and the requirements of these Specifications and the Drawings.

1.4 SUBMITTALS

A. In accordance with section Submittals and Division-26 Section, “Basic Electrical Materials and Methods”, the following shall be furnished:

1. Test Reports: Certified test reports of ground resistance.
2. Certifications: Two weeks prior to final inspection, deliver to the Owner six (6) copies of the certification that the materials and installation are in accordance with the drawings and specifications and have been properly installed.
3. Provide product data for all grounding and bonding components and accessories.

1.5 QUALITY ASSURANCE

A. All grounding components and accessories shall comply with and shall be installed in accordance with NFPA 70, Article 250 of the National Electrical Code, and applicable sections of UL Std 467, "Electrical Grounding and Bonding Equipment", and UL Std 869, "Electrical Service Equipment".

B. Grounding and bonding components and accessories shall be UL listed and labeled for the specific application for which they are being used.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING

A. Provide electrical grounding and bonding components and accessories including, but not limited to, cables and wires, connectors, terminals, jumpers and surge arresters as required for a complete installation.

B. Where more than one product meets the intended requirements, selection shall be at the discretion of the Installer.

C. Provide electrical insulating tape, heat-shrinkable tubing, welding materials, straps and jumpers as recommended by manufacturer's written instructions and in accordance with standard industry practices.

D. All below grade grounding connections shall be exothermic welds and splices and shall be by Caldweld or equal. All materials shall be supplied by one manufacturer to ensure compatibility.

2.2 GROUNDING CONDUCTORS

A. Provide a grounding conductor with green insulation.

B. General purpose insulating grounding conductors have insulation types as identified by the NEC and tested, certified, and labeled in accordance with UL Standards.

C. Non-insulated grounding conductors shall be bare, soft drawn, single or multiple strand annealed copper in wire gauges or sizes as shown on the drawings or consistent with the requirements of NEC Article 250.

2.3 GROUND RODS

A. Ground rods shall be copper clad, solid steel round bars, 3/4 inches (19 mm) in diameter and 10 feet (3 m) in length.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. All equipment, conduit systems, raceway systems, metallic enclosures of electrical devices, switchgear enclosures, transformer frames and equipment, wiring devices and all metallic non-current carrying devices, etc. shall be completely grounded in accordance with the requirements of the National Electrical Code (latest edition).

B. Grounding conductors shall be installed within conduit and shall be sized in accordance with NEC Article 250.

C. Continuity of rigid steel raceways shall be insured by conduit hubs. All grounded neutral conductors shall be continuously identified. All grounding and bonding connections shall be solderless. All grounding and bonding connections to structural steel shall be exothermic welds. Ground fittings at water system

connections shall have rigid clamp jaws. Perforated grounding straps shall not be acceptable.

D. The secondary neutral conductor of transformers shall be continuous, identified throughout and grounded in an approved manner to the grounding electrode system. Conductor used to ground neutral conductor shall be sized in accordance with NEC Article 250.

E. Provide insulated grounding conductors for all feeders and branch circuits. Provide grounding blocks, terminals, etc. for connection of ground wires in all distribution equipment, outlets, junction boxes and utilization equipment.

F. Provide bonding for all metal piping systems and structural steel. Provide bonding connections to cold water and hot water, metal sanitary, gas piping and structural steel. Provide braided copper jumpers at meter, valves, equipment, etc. Bonding shall be in accordance with NEC Article 250.

G. All grounding wire, lugs, jumpers and bus shall be copper except as specifically approved elsewhere in these Specifications.

H. Where parallel feeders are used, each raceway shall contain an equipment ground conductor sized in accordance with NEC Article 250 for the combined parallel circuit amperage.

I. Grounding electrode conductor shall be continuous and no splicing shall be allowed. Equipment grounding conductor splices shall be permitted in device boxes and pulling points, but should be minimized to keep ground resistance as low as possible.

J. Receptacles shall be bonded to their outlet boxes with #12 copper straps. Straps may be omitted if self-grounding devices are utilized.

K. Isolated ground receptacles shall have a dedicated equipment grounding conductor connected at the point where the grounded circuit conductor is connected to the grounding electrode system.

3.2 TESTING

A. The ground resistance at the main switchboard ground bus shall not exceed 10 ohms.

B. Certified test results shall be provided in accordance with the requirements of Division-26 Section, “Inspections, Testing and Start-up” of these Specifications.

END OF SECTION 26 05 26

SECTION 26 05 29

SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, “Basic Electrical Materials and Methods”, apply to this Section.

1.2 SUMMARY

A. Support all raceways, enclosures, cabinets, boxes, and related electrical equipment from the building structure as required by the NEC and as described in these Specifications.

B. Support all lighting fixtures as required by the NEC and as described in these Specifications.

1.3 SUBMITTALS

A. Provide product data for each type of manufactured supporting device.

B. Provide shop drawings for each type of fabricated supporting device.

C. Manufacturer Seismic Qualification Certification: Submit certification that supporting devices, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

    a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.

1.4 QUALITY ASSURANCE

A. All components and the installation of all components shall comply with NFPA 70, "National Electrical Code," requirements.

B. All supporting devices shall be listed and labeled by UL, ETL, CSA or a Nationally Recognized Testing Laboratory (NRTL).

C. Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports and equipment mounting.

D. If there is a discrepancy between devices specifically listed versus devices required for seismic requirements then the seismic requirement shall be met in all cases.

PART 2 - PRODUCTS

2.1 PROHIBITED MATERIALS

A. Nails, wires, perforated tape or plumber's tape are unacceptable for supporting or securing conduits.

2.2 MANUFACTURED SUPPORTING DEVICES

A. Supporting devices shall comply with manufacturer's standard design and construction, fabricated from standard materials in accordance with published product information.

B. Supporting devices shall be protected with a zinc coating or with a similar corrosion resistant coating or treatment. Devices for use outdoors shall be hot-dip galvanized.

C. Raceways shall be supported using clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps. All support devices shall be secured using threaded hardware means. Snap or click type support devices shall not be used.

D. Steel channels and associated support rods shall be selected to accommodate weight of associated raceway and wire.

E. Anchors shall be provided of adequate size to support the load, and shall be compatible with the construction method encountered. Anchors shall be expansion or toggle bolt type.

2.3 FABRICATED SUPPORTING DEVICES

A. Pipe sleeves shall be fabricated from galvanized sheet steel or Schedule 40 galvanized steel pipe.

B. Sheet steel sleeves shall be round tube closed with snaplock, joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gauge steel: 3" (75 mm) and smaller, 20 gauge (1.0 mm); 4" to 6" (100 mm to 150 mm), 16 gauge (1.6 mm); over 6" (150 mm), 14 gauge (2.0 mm).

C. Steel brackets shall be fabricated from angles, channels and other standard shapes. Brackets shall be assembled using welds and/or machine bolts to form a rigid assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instruction and following recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports, clamps and attachments to support piping properly from building structure. Install supports within maximum spacing indicated by NEC or on drawings.

D. Individual conduits shall be secured with steel pipe straps or lay-in pipe hangers.

E. Multiple runs of suspended conduit shall be supported from trapeze style hangers.

F. Multiple runs of conduit on ceiling or wall surfaces shall be mounted on flush or surface steel channels.

G. Ceiling support wires shall not be used for support of conduits.

H. Lighting fixtures shall be supported as recommended by the manufacturer. Recessed incandescent and fluorescent fixtures in suspended ceilings shall not be supported by the ceiling system. Fixtures shall be secured to the building's structure.

I. Raceway supports shall be adequate to carry present and future load multiplied by a safety factor of at least four. In no case shall a support strength of less than 200 pounds (1380 kPa) be used.

J. Manufactured watertight and fire-rated seals shall be provided for sealing conduits and cables passing through sleeves in floors and fire-rated walls. Seals shall be fire-resistant rubber plugs or other materials specifically designed to provide a watertight seal and a UL listed fire-resistant rating which meets or exceeds the rating of the floor or wall.

K. All penetrations by busway or cable tray through floors or fire-rated walls shall be sealed to restore the fire rating around such penetrations. The sealing system shall fill all voids, shall be specifically designed for such use, and shall have a UL listed fire-resistant rating which meets or exceeds the rating of the floor or wall.

L. Cable supports shall be provided for vertical conduits in accordance with NEC Article 300. Cable supports shall be multi-section wedge-type plugs with an outside diameter and the number and size of openings required for the conduit and conductors.

M. Provide vibration isolators between enclosures of all vibration producing equipment, transformers, etc., and their supports or floor. Isolators shall be Mason Industrial type NK neoprene and cork sandwich or equal.

N. Supports are required within 3 feet (900 mm) of each outlet box, junction box, device box, cabinet, conduit body or other tubing terminations.

O. All junction boxes shall be supported from structure.

P. Supporting Devices shall be installed in accordance with manufacturer's recommendations and in accordance with project seismic requirements. Refer to Division 26 Section "Seismic and Wind Controls for Electrical Systems and Equipment' for additional information.

END OF SECTION 26 05 29

SECTION 26 05 33

RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

A. All wiring shall be installed in raceways as hereinafter specified, unless otherwise indicated.

1.3 SUBMITTALS

A. Submit product data for raceways, wireways and fittings.

B. Submit manufacturer's written installation instructions for wireways, surface raceways and non-metallic raceways.

C. Submit pulling calculations for all underground ductbank runs having cables larger than 4/0.

D. For prewired surface raceway installations, submit drawings for approval showing the complete layout of all products that make up the complete system for each floor prior to installation with raceway lengths, device type (power or data), locations and circuits identified.

E. Manufacturer Seismic Qualification Certification: Submit certification that raceways, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

   a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.

1.4 QUALITY ASSURANCE

A. All raceway components and the installation of raceway components shall comply with the following standards:

1. NFPA 70 "National Electrical Code"
2. Applicable NEMA Standards
3. Applicable UL Standards pertaining to raceway system

B. Raceway components shall be listed and labeled by UL, ETL or CSA.

PART 2 - PRODUCTS

2.1 RIGID METAL CONDUIT

A. Rigid metal conduits and couplings shall be full weight, heavy wall steel, galvanized, with threaded connections conforming to the latest editions and revisions of ANSI Standard C-80.1 and Federal Specifications WW-C-581E.

B. Fittings shall be steel or cast malleable iron by Chrouse-Hinds, O-Z, T & B, Steel City, Efcor, or equal. O-Z type "AX" or equal fittings with bonding jumpers shall be used in each rigid metal conduit passing across a building expansion joint. Type of fitting shall be properly chosen for the movement anticipated.

C. Insulating bushings shall be used on all rigid metal conduit terminations and shall be O-Z type "B" or equal.

D. T & B Series 141, or equal, locknuts shall be used on both inside and outside on all enclosures.

E. O-Z type "S", or equal, cable supports shall be used in conduit risers as required by the NEC.

2.2 INTERMEDIATE METAL CONDUIT

A. Intermediate Metal Conduit (IMC) and couplings shall be steel, galvanized, with threaded connections, conforming to the latest editions and revisions of Federal Specifications WW-C-581E and Underwriter's Laboratories Standard 1242.

2.3 ELECTRICAL METALLIC TUBING

A. Electrical Metallic Tubing (EMT) shall be galvanized, conforming to the latest editions and revisions of ANSI Standard C80.3, Federal Specifications WW-563, and Underwriter's Laboratories Standard 797.

B. Expansion fitting with bonding jumpers shall be used in each EMT conduit passing across a building expansion joint.

C. Steel concrete-tight (rain-tight in damp and liquid-tight in wet locations) compression type box connections and couplings with nylon insulating throats shall be used.

D. O-Z type "SBT" or equal, insulated bushing shall be used on all EMT conduit terminations not in metal enclosures.

2.4 FLEXIBLE METAL CONDUIT

A. Flexible metal conduit shall be steel, metal strip interlocked construction, zinc-coated, conforming to the latest editions and revisions of Federal Specification WW-C566B and Underwriter's Laboratories Standard for Flexible Steel Conduit, UL1.

B. Liquidtight flexible metal conduit shall be type UL with PVC cover as manufactured by Anamet: trade name - "Sealtite," or "Hydrotite" as manufactured by Eastern Wire and Conduit or equal, conforming to UL360.

C. Fittings and connectors shall be liquidtight with nylon insulated throat.

2.5 RIGID NONMETALLIC CONDUIT

A. Polyvinyl Chloride (PVC) conduit shall be heavy wall Schedule 40 or Schedule 80 as noted conforming to the latest editions and revisions of Federal Specifications WC-1094, Underwriter's Laboratories Standard UL651, and NEMA Standard TC-2.

B. All joints shall be leakproof, moisture-proof, permanent solvent cement type.

C. Conduit and fittings shall be as manufactured by Carlon, Queen City Plastics or equal.

2.6 RIGID ALUMINUM CONDUIT

A. Aluminum conduit shall not be used.

2.7 CONDUIT BODIES AND FITTINGS

A. All couplings, elbows, cast fittings and conduit bodies shall be made of materials of high quality throughout and shall be a first-grade commercial product, well made and free from mechanical imperfections and defects.

B. Bushings shall be used on all conduits to provide a smooth, well rounded, insulated surface. Bushings shall be metallic with plastic throats. The insulating material shall have a UL temperature rating of 302°F (150°C), it shall be molded-on to the metal and shall become an integral part of the bushing.

C. Erickson or split couplings shall be used in lieu of running threads. Couplings shall be manufactured by O.Z./Gedney, or equal.

D. Entrance seals shall be provided where conduits pass through exterior concrete or masonry walls below grade. The entrance seals shall consist of a hot dip galvanized shell, sealing gland assembly capable of providing a seal around the conduit to withstand fifty feet head of water without leakage. The shell of the seal shall have at least two (2) cast collars at a right angle to the sleeve that is embedded in the concrete. Entrance seals shall be O.Z./Gedney Type WSK, FSK or equal.

E. Conduit hubs shall be malleable iron, zinc plated rain-tight type complete with integral insulated throat, captive O-ring seal and oversize nut. Hubs shall be Myers "Screwtite," O.Z./Gedney "Space Maker," or equal.

2.8 WIREWAYS

A. Electrical wireways shall be of the type, size and number of channels as indicated.

B. Fittings and accessories including but not limited to couplings, offsets, elbows, expansion joints, adapters, hold-down straps, and end caps shall match in form, fit and finish the wireway as required for a complete installation.

2.9 SURFACE RACEWAYS

A. The use of surface raceway is prohibited unless specifically noted otherwise.

B. Surface raceways shall be of the type, size, number of channels and finish specified.

C. Surface raceways shall be low profile, steel with a baked enamel finish. Color to be coordinated with the Architect.

D. All raceways shall include all fittings, bases, covers, end plates and accessories with the same form, fit and finish as the raceway as required for a complete installation.

E. Wiring and receptacles shall be [field] [factory] installed leaving a 2 foot (600 mm) pigtail for field connection and properly tagged for circuit identification in the field].

F. Snap-in covers shall be provided and all receptacles shall be identified by means of permanently etched epoxy screening indicating receptacle voltage, phase and amperage. Device plates shall be nonmetallic, high impact plastic. Plate shall be an overlapping design to cover seams. Plate color shall match raceway.

G. Surface raceways shall be manufactured and assembled in the length and configuration as indicated on the Drawings.

H. Steel raceways shall have a nominal material thickness of 0.040 inches (1 mm).

I. Ground continuity shall be maintained throughout the entire raceway system.

J. Surface raceways shall be two-channel except where specifically noted otherwise. One channel shall be used for power circuits and one channel shall be used for telephone and data circuits. Assembled base and cover shall have minimum dimensions of 4.75 inches (119 mm) high by 1.75 inches (44 mm) deep and maximum dimensions shall be 5.25 inches (1.33 mm) high by 2.0 inches (51 mm) deep. Base shall be dividable by means of a removable barrier section with two (2) equal compartments.

K. Receptacles shall conform to Division-26 section, Wiring Devices.

L. A cutting tool shall be available for the base and cover to ensure clean, square cuts.

M. Each device shall be identified noting the panel number and circuit number from which it is fed.

2.10 POWER POLES

A. The use of power poles is prohibited unless specifically noted otherwise.

B. Power poles shall be of the type, size, number of channels and finish specified.

C. Power poles shall be manufactured from low profile, extruded anodized aluminum or painted steel wire duct system. Steel power poles shall have a gray enamel baked finish.

D. All poles shall include all fittings, bases, covers, end plates and accessories with the same form, fit and finish as the pole as required for a complete installation.

E. Wiring and receptacles shall be provided. All receptacle circuits shall be wired for the entire length of the pole and 12 inch (300 mm) pigtails shall be provided for field connections. Receptacles shall conform to Division-26 Section, Wiring Devices.

F. Snap-in covers shall be provided and all receptacles shall be identified by means of permanently etched epoxy screening indicating receptacle voltage, phase and amperage.

G. Power poles shall be manufactured and assembled in the length and configuration as indicated on the Drawings.

H. Aluminum extrusions shall be No. 6063-T5 aluminum alloy with wall thickness conforming to UL Standards. The overall finish shall be clear, anodized No. A-8625-C Type 2, with minimum anodizing finish of 0.004 inch (.1 mm).

I. Steel power poles shall be fabricated from material with a nominal thickness of 0.040 inches (1 mm).

J. Ground continuity shall be maintained throughout the entire raceway system.

K. Power poles shall be two-channel except where specifically noted otherwise. One channel shall be used for power circuits, and one channel shall be used for telephone and data circuits. Power poles shall be 2-1/4 inches square (1406 mm^2) with two (2) equally sized compartments.

L. Where receptacles or other devices or openings are indicated to be installed in power poles, the devices and openings shall be 18" (450 mm) AFF except where specifically noted otherwise.

2.11 RIGID COATED CONDUIT

A. Prior to application of the coatings, all conduit shall conform to Federal Specification WW-C-581 E, ANSI Standard C80.1 and UL Standard 6.

B. Conduit shall be hot-dip galvanized inside and out prior to coating.

C. Exterior surfaces shall be thoroughly cleaned and treated with an epoxy primer to provide a bond between the zinc and the PVC coating.

D. Adhesion of the PVC coating to coating and fittings shall be greater than the tensile strength of the PVC coating itself.

E. PVC exterior coating shall have a nominal thickness of .040" (1 mm) (40 mils) except where part configuration or application otherwise dictate.

F. Exterior PVC coating on conduit and fittings shall be applied using the fluidized-bed process.

G. A two-part, chemically cured, urethane coating have a nominal thickness of .002" (.05 mm) (2 mils) shall be applied to the interior surfaces of all conduit and feed-through fittings except where prohibited by design.

H. Female coupling and fitting threads, as well as all male threads of conduit, elbows, nipples and fittings shall be protected from corrosion by application of two-part, chemically cured, urethane coating.

I. Each female threaded opening on couplings or fittings shall be protected by an integral PVC sleeve extension formed during the coating process. The sleeve shall extend one pipe diameter or 2" (50 mm) (whichever is less) and have an inside diameter equal to the outside diameter of the uncoated conduit.

J. Form 8 condulets shall be supplied with stainless steel screws with polyester encapsulated heads. Form 7 condulets shall be supplied with stainless steel screws.

K. Finished conduit shall fully conform to the current NEMA Standard RN-1 and shall have a label affixed indicating compliance with UL Standard 6.

L. Interior and exterior coating shall afford sufficient flexibility and elongation to permit field banding without damage.

M. Approved Material: Perma-Cote supreme as manufactured by Perma-Cote Industries.

2.12 IDENTIFICATION

A. Exposed raceways shall be identified at junction and pull boxes and at points not more than 20 feet (6 m) on centers. See Division-26 Section, Basic Electrical Materials and Methods for additional identification requirements.

B. Labels shall indicate the system voltage and/or type of service and shall have an appropriate legend, such as:

1. 480 VOLTS - POWER
2. 480Y/277 VOLTS - LIGHTING
3. 208Y/120 VOLTS - LIGHTING
4. 208Y/120 VOLTS - POWER
5. 120 VOLTS - CONTROL
6. TELEPHONE

C. Labels shall appear in white letters of 1/2 inch (13 mm) minimum height on a black background. Labels shall be installed in accordance with the manufacturer's instructions and sizes shall match the conduits to which they are applied. Labels shall be ordered sufficiently prior to their need so that they will be on hand when required for installation. Failure to allow adequate time for delivery of labels, including special legends, will not be considered valid reason for substitution of labels of a different type.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Exterior locations above grade - rigid metal conduit.

B. Crawl spaces - intermediate metal conduit.

C. Interior exposed locations, where subject to physical damage up to 10' - 0" (3 m - 0 mm) AFF – rigid metal conduit. Electrical metallic tubing where not subject to physical damage.

D. Interior exposed locations, above 10' - 0" (3 m - 0 mm) AFF - electrical metallic tubing.

E. Damp or wet locations - rigid metal conduit.

F. Within concrete and masonry exterior walls - intermediate metal conduit.

G. Within concrete floor slabs - rigid nonmetallic Schedule 40 PVC with rigid metal conduit stub-ups.

H. Below slabs on grade - rigid nonmetallic Schedule 40 PVC with rigid metal conduit stub-ups.

I. Conduits for all conductors rated greater than 600V – rigid nonmetallic Schedule 40 PVC in concrete encased ductbank.

J. Interior concealed locations, accessible, dry - electrical metallic tubing.

K. Interior concealed locations, non-accessible, dry - electrical metallic tubing.

L. Direct buried, exterior, feeders - rigid nonmetallic Schedule 80 PVC

M. Direct buried, exterior, branch circuits - rigid nonmetallic Schedule 80 PVC.

N. Ducts encased in minimum of 3 inch (75 mm) thick concrete - rigid nonmetallic Schedule 40 PVC. All ducts shall have a round exterior with a round bore.

O. Connections to motor terminal boxes, control panels mounted on equipment, dry-type transformers and other vibration producing equipment, dry locations - flexible metal conduit, 18"-36" (450 mm-900 mm) length.

P. Connections to motor terminal boxes, control panels mounted on equipment, dry-type transformers and other vibration producing equipment, damp and wet locations - liquidtight flexible metal conduit.

Q. Recessed lighting fixtures, between fixture and its respective outlet box - flexible metal conduit in lengths as permitted by the NEC, and providing sufficient slack to permit removal of fixture and access to outlet box.

R. Minimum conduit size shall be 3/4" (19 mm).

3.2 INSTALLATION

A. Unless otherwise noted on the contract drawings, all raceways shall be installed concealed in the floors, ceilings, walls or partitions of the building, and in such a manner as not to impair the integrity of the structure. Unless otherwise specified, raceways may be installed exposed in mechanical rooms, electrical rooms, large storage spaces and in large janitor's closets, pipe shafts, suspended ceiling spaces, and where required for equipment connections. Exposed raceways shall be installed parallel or perpendicular to walls, structural members or intersection of vertical planes and ceilings, with right angle turns consisting of box-type fittings or symmetrical bends.

B. The Contractor shall exercise the necessary precautions to prevent water, dirt, plaster or trash in raceways, fittings and boxes during the course of installation; raceways, fittings, or boxes clogged in such manner that cannot be thoroughly cleaned, shall be replaced. All unconnected conduit ends shall be properly capped. Raceways shall be kept at least 12 inches (300 mm) from parallel runs of flues, steam pipes or hot water pipes. Bends and offsets shall be kept to a minimum, and they shall be made without flattening or deformation with approved hickey or bending machine; the radius of the curve of the inner edge of any field bend shall not be less than the value specified in the National Electrical Code. Raceway runs shall not exceed 100 feet (30 m) between outlets; where necessary, even though not indicated on the drawings, box-type fittings or pull boxes shall be installed. Moisture traps shall be avoided as much as possible. Except as noted, raceways shall not be installed horizontally within concrete slabs-on-grade; raceways shall be installed underground, below the slab. Expansion fittings or other approved devices shall be used to provide for expansion and contraction where raceways cross expansion joints.

C. Raceways shall have supports spaced not more than 8 feet (2400 mm) apart, except in vertical risers where 2 inch (50 mm) and larger rigid metal conduit may be supported at intervals not larger than 15 feet (4.5 m). Raceways shall be supported on approved types of zinc-coated wall brackets, clamps, ceiling trapeze hangers, strap hangers, or pipe straps firmly secured in an approved manner. All ends of raceways shall be reamed to remove rough edges. Raceways shall be firmly attached to sheet-metal enclosures NEMA type 1 by means of proper metallic, plastic throated bushings and locknuts; and to sheet-metal enclosures NEMA types 3, 4, 6, 12 or 13, by means of interchangeable, metallic, plastic-throated, raintight hubs. When installing locknuts and bushings, care shall be observed to see that the full number of threads project through to permit the bushing to be drawn tight against the end of the conduit, after which the locknut shall be made up sufficiently rigid to draw the bushing into firm electrical and mechanical contact with the box; two locknuts, one inside and one outside, plus the bushing, shall be used where required. Proper electrical continuity shall be established throughout the entire raceway system. An approved compound shall be applied to all field threads before installation.

D. Conduits may be installed in concrete floor slabs with the following limitations:

1. Maximum size - 1-1/4" (32 mm). Conduits larger than 1-1/4" (32 mm) may be installed in concrete floor slabs only with the specific permission of the Architect and Structural Engineer, or as specifically indicated on the drawings, all in accordance with the following limitations.

    a. Minimum concrete cover - 1" (25 mm), above and below.
    b. Minimum spacing between conduits - 7-1/2" o.c. (188 mm).
    c. Maximum conduit outside diameter - 1/3 of slab thickness.
    d. Installed between bottom and top reinforcing.
    e. Secured to prevent possible change in positions as concrete is poured.
    f. Water or damp-proofing integrity of slab is not disturbed.

2. Conduits in close proximity to each other at panelboards, etc., shall be wrapped with wire mesh to prevent cracking of slab.
3. Conduits shall not be installed in post tension slabs.

E. All conduits shall be tested for clearance and smooth joints and then capped immediately after installation by T & B "push penny" plugs, or equal, to prevent entrance of moisture or debris.

F. No wire shall be pulled into conduits until system is complete and the building is thoroughly dry.

G. Conduits to outlets in demountable or dry wall partitions shall be run in ceiling spaces and not in floor slabs.

H. Conduits turning from floor slabs up into partitions shall be totally concealed.

I. Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces, cold air plenums, etc., shall be suitably sealed with "Duxseal" by Johns Manville or sealing fittings to prevent accumulation of condensation.

J. Conduits and sleeves penetrating floor slabs and fire-rated partitions shall have the chopped out space between the outer wall of the piping and the concrete sealed with fire resistant material listed by UL for use in fire rated floor and partition systems. Sleeves penetrating floor slabs shall extend 1-1/2" (40 mm) above the finished floor.

K. Conduits less than 12" (300 mm) in length connecting outlets of adjoining rooms shall be sealed with "Duxseal" by Johns Manville to prevent noise transmission between rooms.

L. Pull wires shall be installed in all empty conduits. Use No. 14 AWG monofilament plastic line having not less than 200-lb. (1380 kPa) tensile strength. A minimum of 12 inches (300 mm) of slack shall be provided at each end of the pull wire.

M. Raceways shall be installed in accordance with manufacturer’s recommendations and in accordance with project seismic requirements. Refer to Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment” for additional information.

3.3 UNDERGROUND DUCTS

A. Underground electrical and communication ducts shall be located a minimum of 6 feet (1800 mm) away from steam and hot water lines except at crossings where a 1 foot (300 mm) separation shall be permitted.

B. Unless otherwise noted or specified, underground raceways shall be installed 36 inches (900 mm), minimum, below grade for 600 volts, or less, and 36 inches (900 mm), minimum, below grade for higher voltages. The bottom of the trench shall be even and firm and shall be free of rocks and sharp objects; the trench shall be backfilled with clean, rock-free soil, in 6-inch (150 mm) layers and each layer shall be compacted before addition of subsequent layers. The surface (turf, sidewalk, roadway, etc.) shall be restored to its original condition.

C. Ducts shall be installed below the frost line at the project site location.

D. Direct buried ducts shall be covered with not less than a 6-inch (150 mm) layer of sand before being backfilled.

E. Ducts for electrical power circuits shall be completely isolated from ducts for communication circuits. Separate access points and termination points shall be

provided. Ducts for electrical power circuits and ducts for communication circuits may share the same trench when such an arrangement is approved by the appropriate utility or contractor.

F. A minimum 3 inch (75 mm) clearance shall be maintained between raceways in multiple raceway installations unless noted otherwise. Rigid PVC spacers shall securely support and maintain uniform spacing of the duct assembly. A minimum of 3 inches (75 mm) shall be maintained between the duct assembly and the bottom of the trench during backfilling unless noted otherwise. Spacers shall be installed at intervals not exceeding 4 feet (1200 mm) unless noted otherwise. Provide non-ferrous tie wires to prevent displacement of the ducts. Tie wires shall not act as substitutes for spacers.

G. Ducts shall be sloped away from building and equipment entrances. Pitch shall be not less than 4 inches (100 mm) in 100 feet (30 m). Curve sections in duct lines shall consist of long sweep bends. The use of manufactured bends shall be limited to building entrances and stub-ups to equipment.

H. Only standard 2,500 psi (17,237 kPa) ready-mix concrete with air entrainment and pea gravel will be approved for encasement.

I. Underground conduit stub-ups to equipment inside of buildings shall be galvanized rigid steel. Stub-ups to equipment mounted on outdoor concrete slabs shall be galvanized rigid steel. Install insulated grounding bushings on the terminations. The steel stub-ups shall be coupled to the ducts with suitable adapters.

J. Ducts shall be kept clean of earth, sand or gravel during construction, and sealed with tapered plugs upon completion of each portion of the work. Upon completion of the duct bank installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of soft earth, sand, or foreign material left in the duct line. The mandrel shall be not less than 12 inches (300 mm) long, and shall have a diameter 1/2 inch (13 mm) less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be slightly larger than the diameter of the duct.

K. Seal the ducts and conduits at building entrances, and at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of moisture and gases.

L. Duct lines shall terminate at window openings in manhole walls as shown on the Drawings. All ducts shall be fitted with end bells.

M. Couple the ducts with proper couplings. Couplings shall be staggered in rows and layers to insure maximum strength and rigidity of the duct bank.

N. Where new ducts, conduits, and concrete envelopes are to be joined to existing manholes, handholes, ducts, conduits, and concrete envelopes, make the joints with the proper fittings and fabricate the concrete envelopes, where applicable, to insure smooth durable transitions.

O. Underground cables, raceways and ducts shall have a continuous strip of heavy gage plastic approximately 6 inches (150 mm) wide installed 12 inches (300 mm) below the surface over ducts or conduits before backfilling trenches. Plastic strip shall be printed with the words "Caution - Buried Electrical Line Below," or a similar phrase approved by the Engineer.

P. All underground installations intended for local power company service cables shall conform to the latest requirements of the local power company. The Contractor is responsible for obtaining a copy of the aforementioned power company handbook and is also responsible for full compliance. The power company requirements shall take precedence over any conflicting information provided under this contract.

3.4 EXCAVATION AND BACKFILLING

A. The Contractor shall provide necessary excavation and backfill for the installation of electrical work. The Contractor shall coordinate work with other trades to avoid interference and minimize trenching. Establish all lines and grades required for the proper location of the work and be responsible for the correctness thereof. Verify location and check elevations of all existing utilities before starting work.

B. Provide guard rails and other necessary safeguards around excavation. Provide shoring, bracing, etc. to protect work, safety of personnel, and existing utilities and underground work. Provide protection against injury of adjacent property. Keep excavation drained and pumped out. Do not permit debris and other materials to enter drains and piping.

C. Excavate to depth and width required for proper installation of electrical work with minimum clearance of 8 inches (200 mm) on each side and minimum overdepth of 6 inches (150 mm). Excavated materials not required or suitable for backfill shall be removed from the site. Where excess excavation is made, backfill to required level with concrete or crusher run (CR6).

D. Provide bedding of firmly compacted sand, providing uniform support, to centerline of conduit, duct, ductbank or cable. Minimum depth of sand below conduit, duct, ductbank, or cable shall be three inches (75 mm). Deposit initial layer of backfill, six inches (150 mm) deep, over conduit, duct, ductbank or cable and tamp. Deposit individual layers of backfill in 6 inch (150 mm) layers and tamp. Backfill material under roadway, structures, and equipment, etc. shall be compacted sand. Backfill material shall be free of organic matter, cinders, frozen earth or rock larger than 4 inches (100 mm) in any dimension.

E. Repair and/or replace any curbs, roads, walks fences, utilities or structures disturbed as a result of the work. Seed or sod all areas disturbed as a result of the work.

3.5 CLEANING

A. Inspect all raceways; clear all blockages; and remove all burrs, dirt and construction debris from raceways before installing conductors.

END OF SECTION 26 05 33

SECTION 26 05 34

BOXES, FITTINGS AND CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, “Basic Electrical Materials and Methods”, apply to this Section.

1.2 SUMMARY

A. Provide and install outlet boxes, pull and junction boxes, cabinets and enclosures as required by the Drawings and as required by field conditions for a complete installation in accordance with the National Electrical Code.

1.3 SUBMITTALS

A. Provide product data for all cabinets and enclosures.

1.4 QUALITY ASSURANCE

A. All items provided under this Section shall be listed and labeled by UL or a Nationally Recognized Testing Laboratory (NRTL).

B. The components and installation shall comply with NFPA 70 "National Electrical Code."

C. Enclosures shall comply with NEMA Standard 250, "Enclosures for Electrical Equipment."

D. Manufacturer Seismic Qualification Certification: Submit certification that the enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.

PART 2 - PRODUCTS

2.1 METALLIC OUTLET BOXES

A. Outlet boxes shall conform to UL 514A, "Metallic Outlet Boxes, Electrical," and fittings shall conform to UL 514B, "Fittings for Conduit and Outlet Boxes."

B. Outlet boxes for indoor and dry locations shall be minimum 4" (100 mm) square or octagonal, 2-1/8 inch (53 mm) deep, zinc-coated sheet steel with stamped knockouts, threaded screw holes and mounting accessories suitable for each location and application. Straps, cable clamps, exterior rings and fixture studs shall be provided as required.

C. Outlet boxes for outdoor or wet locations shall be minimum 4" (100 mm) square copper-free aluminum cast boxes with threaded raceway entries, threaded screw holes and mounting accessories suitable for each location and application. Straps, mounting feet, closure plugs, cable clamps, exterior rings and fixture studs shall be provided as required.

D. Outlet boxes in concrete construction shall be of sufficient depth to keep conduits a minimum of 1" (25 mm) from the wall surface.

E. No "thru-wall" boxes shall be used in partitions.

F. Steel floor boxes shall be sheet steel construction, concrete tight, fully adjustable, with stamped knockouts, adjusting rings, and brass floor plates.

G. Outlet boxes in masonry partitions shall have square corners with no mounting tabs and shall be of sufficient depth to suit the block or brick construction.

2.2 NONMETALLIC OUTLET BOXES

A. Nonmetallic outlet boxes shall not be used.

2.3 ACCESS FLOOR BOXES

A. Access floor boxes shall be fabricated from minimum 14 gauge galvanized steel. Boxes shall have a reinforced hinged cover with flange suitable for accepting carpet, tile or high pressure laminate. The box shall provide an unobstructed enclosure for power receptacles, data and communication outlets.

B. Access floor boxes shall be provided with two (2) duplex receptacles, NEMA 5-20R, and two (2) duplex data outlets unless noted otherwise.

C. Access floor boxes shall be removable from the access floor without disturbing floor panels. Access to box wiring space shall be through a removable cover on the bottom or back of the box. The top cover shall be capable of being closed with cords and cables exiting from the box. Cords and cables shall be protected

from the closed cover by a retractable cable exit. When the cover is closed and no cords or cables are in place there shall be no obstructions above the floor.

D. Access floor boxes shall have metallic cover plate and shall provide fire rating equal to that of the concrete floor slab.

2.4 PULL AND JUNCTION BOXES

A. Pull and junction boxes over 100 cubic inches (.0016 m^3) in volume shall comply with UL Standard 50, "Electrical Cabinets and Boxes."

B. Boxes shall have screwed or bolted-on covers of the same material as the box and shall be sized to accommodate the application and the site conditions.

C. Sheet steel boxes shall have welded seams and shall have structural bracing where required to provide a rigid assembly.

D. All boxes for concealed work shall be constructed of minimum 12 gauge galvanized sheet steel with welded seams and shall be provided with mounting brackets. Integral bracing shall be provided where required to provide a rigid assembly.

E. All boxes installed in wet locations or on the building exterior shall be constructed from galvanized sheet steel with gasketed covers.

2.5 CABINETS

A. Cabinets shall conform to UL Standard 50, "Electrical Cabinets and Boxes."

B. Backboxes shall be constructed from galvanized sheet steel, and fronts and doors shall be constructed from rolled sheet steel. Cabinets shall be NEMA 1 except as otherwise noted. Cabinets shall consist of a box and a one-piece frame front with a hinged door. Concealed fasteners shall secure front to box and provide adjustment to permit alignment of front and box.

C. Hinges shall be flush, shall not be more than 6" (150 mm) from the top and bottom of the door, and shall be no more than 24" (600 mm) apart. Doors greater than 48" (1200 mm) in height shall have 3-point latching mechanism.

D. Surface mounted cabinets shall have fronts of the same height and width as the box. Flush mounted cabinets shall have fronts which extend 3/4" (19 mm) beyond box in all directions.

E. Double doors shall be provided for cabinets wider than 24" (600 mm).

F. Doors shall have combination spring catch and key lock. All locks for cabinets of a common system shall be keyed alike.

PART 3 - EXECUTION

3.1 OUTLET BOXES

A. Outlet boxes shall be firmly secured in place, plumb and level. Outlet boxes installed in suspended ceilings shall not be supported from the ceiling system.

Outlet boxes for like devices shall have a uniform mounting height unless specifically noted otherwise.

B. Outlet boxes over windows and doors shall be installed 7'-6" (2250 mm) above the finished floor, centered over the door or window unless otherwise noted.

C. Outlet boxes shall be 6"-12" (150 mm-300 mm) from the strike side of the door frame when installed adjacent to a door opening.

D. Outlet boxes at fixed work surfaces and counter tops shall be installed with the center of the box 6" (150 mm) above the work surface or counter surface unless otherwise noted.

E. Covers shall be installed on all outlet boxes.

F. Outlet boxes for wall mounted video equipment shall be installed with the center of the box 80" (2000 mm) above the finished floor or 6" (150 mm) below the finished ceiling, whichever is lower.

G. Outlet boxes for electric water coolers shall be wall mounted and shall not be visible after the water cooler is installed. Mounting height shall be coordinated in the field.

H. Coordinate outlet box locations with baseboard heating units. Contractor shall adjust box locations where necessary to accommodate installation and listing requirements of baseboard heating units. Advise Owner/Engineer of any necessary adjustments. Outlet boxes shall be installed above hydronic baseboard heat and below electric baseboard heat.

I. Outlet box mounting heights are as indicated. Mounting heights shall be to the center line of the box.

3.2 PULL AND JUNCTION BOXES

A. Pull and junction boxes shall be no smaller than 8 inches (200 mm) square by 4 inches (100 mm) deep.

B. Boxes shall be the minimum size as required by the National Electrical Code or larger as indicated on the Drawings.

C. Junction and pull boxes shall be furnished and installed where indicated on the Drawings or where required by the NEC.

D. Boxes for communication, data and signaling systems shall be 50 percent larger than the size required by the NEC and shall be located to permit ready access for installation of future raceways and conductors.

E. Pull and junction boxes shall be installed in accordance with manufacturer's recommendations and in accordance with project seismic requirements. Refer to Division 26 section "Seismic and Wind Controls for Electrical Systems and Equipment" for additional information.

3.3 CABINETS AND ENCLOSURES

A. Fronts of cabinets and enclosures shall be mounted straight and plumb with building surfaces.

B. Cabinets and enclosures 68" (1700 mm) or less in height shall be installed with the top of the cabinet or enclosure 72" (1800 mm) above the finished floor. All cabinets and enclosures shall be installed in accordance with the NEC.

C. Cabinets and enclosures installed adjacent to one another shall be installed with the tops of the cabinets and enclosures at the same height.

D. Cabinets and enclosures in finished areas shall be flush with the walls. Cabinets and enclosures in mechanical and electrical rooms shall be surface mounted unless otherwise noted.

E. Cabinets and Enclosures shall be installed in accordance with the manufacturer's recommendations and in accordance with project seismic requirements. Refer to Division 26 section " Seismic and Wind Controls for Electrical Systems and Equipment" for additional information.

3.4 GROUNDING

A. All metallic boxes, cabinets and enclosures shall be effectively grounded in accordance with Article 250 of the NEC.

B. Provide a grounding terminal in the interior of all boxes, cabinets and enclosures.

3.5 CLEANING

A. After installation, clean and repair all boxes, cabinets and enclosures. Galvanized finishes shall be repaired using a zinc-rich paint as recommended by the manufacturer. Painted finishes shall be repaired using a matching paint from the manufacturer.

END OF SECTION 26 05 34

SECTION 26 05 43

UNDERGROUND ELECTRICAL STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, “Basic Electrical Materials and Methods”, apply to this section.

1.2 SUMMARY

A. The Contractor shall furnish and install all manholes, handholes, and all accessories and materials required for a complete underground distribution system as indicated on the Drawings.

B. The Contractor shall coordinate all work with the appropriate utilities and with the Owner. No work shall be performed until a written schedule is provided to the Owner, and written approval of the schedule is received from the Owner.

1.3 SUBMITTALS

A. Provide manufacturer's product data for all fittings, precast manholes, handholes, and all manufactured accessories.

B. Provide Shop drawings for all cast-in-place manholes, handholes, and all field-fabricated supports, brackets and accessories.

C. Provide site plans and profiles of manholes, handholes, and ducts.

D. Provide structural calculations for manholes stamped and signed by a registered professional structural engineer employed by the manhole manufacturer.

1.4 QUALITY ASSURANCE

A. All underground manholes and handholes and the installation of underground manholes and handholes and components shall comply with the following standards:

1. NFPA 70, "National Electrical Code"
2. National Electrical Contractors Association's "Standard of Installation"
3. Applicable IEEE/ANSI Standards

PART 2 - PRODUCTS

2.1 PRECAST MANHOLES AND HANDHOLES

A. Manholes and handholes, shall be precast concrete, with dimensions indicated on the Drawings.

B. Manholes and handholes for electrical power circuits shall have a sleeve for a ground rod.

C. Covers shall be round and shall provide a minimum 36 inch (900 mm) opening. Covers shall identify the type of service: "Electric" or "Communication". Covers shall have a recessed handle or other provisions for lifting.

D. Pulling-in irons shall be provided opposite each duct opening and where there are provisions for future duct entrances.

E. Cable racks shall be provided to properly support both ends of cable joints and splices. A minimum of two cable racks shall be provided on each wall except where racks would interfere with duct entrances. Cable racks shall be spaced 36-48 inches (900-1200 mm) for power cables, 30 inches (750 mm) for communication cables.

F. A sump pit and cover shall be provided. The sump shall have a 12" (300 mm) opening and 12" (300 mm) depth. The bottom of manholes and handholes shall be sloped to drain into the sump.

G. End bells shall be provided for all duct entrances.

H. When installed for use by BGE, all underground manhole and handhole installations intended for BGE service cables shall conform to the requirements of the latest version of BGE “Electric Service and Metering Manual". The Contractor is responsible for obtaining a copy of the aforementioned BGE handbook and is also responsible for full compliance. The BGE requirements shall take precedence over any conflicting information provided under this contract.

2.2 POLYMER CONCRETE UNDERGROUND ENCLOSURES

A. Enclosures shall be polymer concrete. The enclosures shall be suitable for direct buried applications in soil, concrete embedment, or asphalt embedment.

B. The enclosures shall be concrete/cement gray in color, unless otherwise specified.

C. The enclosure dimensions shall be as indicated on the Drawings. The enclosure shall have an open bottom. Knockouts shall be notched to allow for a smooth edge upon removal.

D. The cover shall have a logo that reads “ELECTRIC” or “COMMUNICATION”. The cover shall have two lifting eyes/pull slots with the following dimensions – 1/2” x 4” with a ¼” center pin. The cover’s surface shall be skid resistant and have a minimum coefficient of friction of 0.50, as specified in current ANSI/SCTE 77. The cover shall have two locking bolt slots, and two 3/8” – 16 UNC hex head bolts to secure the cover into the box.

E. The enclosures (box and cover) shall comply with all of the environmental tests as per current ANSI/SCTE 77.

F. The enclosures (box and cover) shall be current ANSI/SCTE 77 Tier 22 and shall be UL Listed to 66WF and tested to the full ANSI standard

G. Basis of Design is Hubbell enclosures such as Quazite or approved equal.

PART 3 - EXECUTION

3.1 MANHOLES AND HANDHOLES

A. Manholes and handholes, shall be installed by or under the supervision of the manufacturer, in accordance with the manufacturer's written instructions.

B. Brick collars shall be used to bring the cover of manholes and handholes to the finished grade.

C. Manholes and handholes shall be located in accordance with the Drawings, and shall be set in place on a gravel bed to ensure a plumb installation.

D. All ductwork and manholes for use by BGE shall be installed under strict supervisions and coordination with BGE in accordance with BGE requirements. It is the Contractor’s responsibility to contact BGE for all coordinatio9n and inspections.

3.2 POLYMER CONCRETE UNDERGROUND ENCLOSURES

A. Provide excavation and backfilling include minimum 6” gravel base under the enclosure assembly with the gravel 3” to 4” wider than the sides of the enclosure. (Internal Bracing may be warranted for any manufacturer’s underground enclosure if 95% compaction is required or if heavy vehicles are going to be present during construction and/or throughout the life of the enclosure. See manufacturer recommended practices and instruction including applicable sizes that would require internal bracing).

END OF SECTION 26 05 43

SECTION 26 05 49

SEISMIC AND WIND CONTROLS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section specifies the minimum requirements for restraining Electrical systems and equipment.

B. This project has seismic equipment and construction requirements. Refer to structural drawing No. SO.1 for applicable project seismic load design parameters. In addition to other project requirements, all electrical system components supports, supports and attachments shall be designed and installed in accordance with applicable International Building Code (IBC) and American Society of Civil Engineers (ASCE) 7 requirements. All electrical system components, supports and attachments have been assigned a Component Importance Factor (IP) of 1.5 for this project. Provide appropriate seismic support devices and installation methods for all electrical equipment. Provide all labor, materials, tools, coordination, site inspections, additional design and all incidentals required to provide seismic electrical equipment, systems and supporting devices in accordance with applicable IBC and ASCE 7 requirements (Chapter 13, Seismic Design Requirements for Nonstructural Components).

Provide all applicable seismic certifications for all electrical equipment and components in accordance with applicable sections of IBC and ASCE 7. All electrical components shall be rated for and certified for use within the given seismic parameters.

All supports and attachments used for electrical equipment and components shall be rated for and certified for use within the given seismic parameters. Provide project specific design and documentation in accordance with applicable sections of IBC and ASCE 7 prepared, submitted and signed by a registered professional engineer.

Provide independent 3rd party inspection of seismic installation in accordance with applicable sections of IBC and ASCE 7. Provide written report documenting findings prepared, submitted and signed by a registered professional engineer.

C. This Section includes the following:

1. Restrained elastomeric isolation mounts and pads
2. Restrained spring isolators
3. Restrained vibration isolation roof curb/rail assemblies
4. Restraint snubbers

5. Restraining braces and cables
6. Flexible connectors for restraint applications

1.3 APPLICABLE STANDARDS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

D. ASCE-7: Minimum Design Loads for Buildings and Other Structures.

1.4 PERFORMANCE REQUIREMENTS

A. All Electrical components shall be mounted to resist seismic loads per IBC requirements. Applicable IBC and ASCE 7 requirements.

B. Seismic-Restraint Loading:

1. Refer to project structural drawing No S0.1 for seismic load design parameters.
2. Component Importance Factor (Ip) = 1.5 for all electrical system components, supports and attachments.
3. If additional information is required then it shall be requested prior to the original bid date allowing sufficient time for response.
4. See Geotechnical Report for additional requirements.

C. If there is a discrepancy in individual specification sections between devices specifically listed versus devices required for seismic requirements, then the seismic requirement shall be met unless noted otherwise.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of restraint component used.

B. Delegated-Design Submittal: For restraint details indicated to comply with performance requirements and design criteria, include project specific load analysis data signed and sealed by the qualified professional engineer responsible for their preparations.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation and seismic and wind forces required to select restraints.
2. Seismic Details:

a. Design Analysis: To support selection and arrangement of seismic and/or wind restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings.

Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic and/or wind load events. Indicate association with vibration isolation devices.

c. Coordinate seismic restraint details required for equipment mounted outdoors. Comply with requirements in other Division-26 Sections for equipment and components mounted outdoors.

d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES showing maximum ratings for concrete anchors (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for Electrical conduit and equipment with other systems and equipment in the vicinity, including other supports and seismic and/or wind restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer.

F. Field quality-control inspection reports.

G. Equipment Seismic Certificates.

H. Support and attachment design documentation

I. Report for 3rd party inspection.

1.6 QUALITY ASSURANCE

A. Comply with seismic restraint requirements in the IBC and ASCE 7 unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Restraint devices shall have horizontal and vertical load analysis and shall bear anchorage preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum restraint ratings. Submittals based on independent testing and/or calculations are acceptable. Calculations (including combining shear and tensile loads) to support restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements of this section, provide products by Kinetics Noise Control or approved equal.

2.2 COMBINATION RESTRAINT/VIBRATION ISOLATION DEVICES FOR NON-CURB MOUNTED EQUIPMENT

A. Restrained Rubber/Neoprene Mounts, Model RQ: All-directional restrained mountings.

1. Materials: Cast-ductile-iron or welded steel housing containing oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

B. Restrained Spring Isolators, Model FHS: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 150 percent of rated load, fully compressed, without deformation or failure.
5. Housing: Factory drilled for bolting to structure

C. Restrained Spring Isolators, Models FLS / FLSS: Freestanding, steel, open-spring isolators with limit-stop/restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 150 percent of rated load, fully compressed, without deformation or failure.

D. Side Mount Restrained Spring Isolator, Model FMS: Side mount spring isolator with integral restraint snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional restraint.
2. Base: Factory drilled for bolting to structure.
3. Equipment Mount: Factory drilled for bolting to the equipment.
4. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.
5. Overload Capacity: Support 150 percent of rated load, fully compressed, without deformation or failure.

2.3 COMBINATION RESTRAINT/VIBRATION ISOLATION DEVICES FOR CURB MOUNTED EQUIPMENT

A. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb and rail designed to resiliently support equipment and to withstand seismic and wind forces.

1. All of the components within the final product and including the final product are to be manufactured within the United States of America.
2. Complete curb and isolation assembly shall be stamped by a Professional Engineer licensed in the jurisdiction of the project.

3. Provide sloped and/or extended height curb assemblies as necessary to coordinate with roof slope and buildup.

B. Sheet Metal Restraint/Spring Isolation Curbs, Model KSCR: Upper frame shall consist of extruded aluminum top rail, shall provide continuous support for equipment, and shall be captive to resiliently resist seismic and wind forces. Lower support assembly to be constructed out of formed heavy gage sheet metal, shall have a means for attaching to building structure, contain a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches (50 mm) of rigid, glass-fiber insulation on inside of assembly.

C. Structural Steel Restraint/Spring Isolation Curbs, Model ESR: Upper frame shall consist of a structural steel C channel to provide continuous support for the equipment and provide a place of attachment to the equipment. The lower frame shall be constructed from structural steel and shall provide adequate support to resist seismic and wind loads. The springs shall be adjustable, restrained with 1/4-inch (6-mm) thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic/wind restraint.

    a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
    b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
    c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
    d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
    e. Overload Capacity: Support 150 percent of rated load, fully compressed, without deformation or failure.

2. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

    a. Resilient Material: Oil- and water-resistant hermetically sealed compressed fiberglass.

3. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch (6 mm) thick.
4. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.
5. Extend height of curb as necessary to allow for spring isolator access after roof buildup is installed.

2.4 FLEXIBLE CONNECTORS TO ACCOMMODATE DIFFERENTIAL MOTION

A. Basis-of-Design Product: Subject to compliance with requirements of this section, provide flexible connectors to accommodate differential motion by Engineered Flexible Products (EFP) or equivalent.

B. General Requirements for Flexible Connectors to Accommodate Differential Motion:

1. Flexible connectors shall be chosen to accommodate differential motion caused where conduit crosses seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.
2. Flexible connectors shall not introduce any thrust loads into the distribution system and shall contain a welded on braid.
3. Flexible connectors shall be constructed of stainless steel braid with carbon steel end fittings and/or bronze braid with copper end fittings.
4. Flexible connectors shall be V-shaped and capable of accommodating up to 4 inches (100 mm) of differential motion from centerline.
5. Flexible connectors shall be supplied by restraint supplier as part of restraint system.

2.5 SEISMIC RESTRAINT DEVICES

A. General Requirements for Concrete Anchoring Components:

1. Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.
2. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be per IBC.

B. Snubbers, Model KSMS / KSMG: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismically rated, with an ICC-ES report.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.

C. Cable Restraint Kit, Model KSCU, KSWC, or KSCC: A pair of pre-stretched steel cables with end connections made of steel assemblies with thimbles (if vibration isolation is needed), brackets, swivels, and bolts designed for restraining cable service.

1. Kit shall include all hardware required for connection to the equipment/system.
2. Kit shall include a tool-less connector to avoid cable cutting and saddle clamps where possible.
3. Cables shall have one end pre-swaged from the manufacturer.

4. Cable size shall be 2 mm, 3 mm, 5 mm, and/or 6 mm in diameter depending on calculated design load.
5. Building and equipment attachment brackets at each end of the cable shall be designed to permit free cable movement in all directions up to a 45-degree misalignment. Protective thimbles shall be used at sharp connection points as required to eliminate potential for dynamic cable wear and strand breakage.

D. Hanger Rod Stiffener, Model KHRC: Clamp for attaching reinforcing steel angle to hanger rod.

E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

G. Resilient Isolation Washers and Bushings, Model TG: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

H. Mechanical Anchor Bolts, Model KCAB/KCCAB/KUAB: Select anchor bolts with strength required for anchorage and as tested according to ASTM E 488. Minimum length of anchor to be eight times diameter.

1. Anchor bolts to be zinc-coated steel for interior applications and stainless steel for exterior applications.
2. For equipment that is rigidly mounted and has 10 horsepower or less use drilled-in and stud-wedge or female-wedge type anchor.
3. For equipment that is rigidly mounted and has greater than 10 horsepower, use undercut anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Conduit Supports: Secure conduits to trapeze member with clamps approved by Professional Engineer of record for the project.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on delegated design drawings to receive them and where required to prevent buckling of hanger rods due to seismic and/or wind load forces.

C. Strength of Support and Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic and/or wind loads within specified loading limits.

3.3 SEISMIC DEVICE INSTALLATION

A. Comply with requirements in architectural specifications for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install restraint snubbers on equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Combination restraint/vibration isolation devices may be installed in lieu of separate vibration isolators and restraint snubbers if they conform to all requirements of this specification.
3. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
4. Install restraint devices using methods provided by restraint supplier and required submittals for component.

C. Electrical Restraints:

1. Comply with requirements of restraint system manufacturer.
2. Restrain all electrical equipment, components and interconnections.

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install restraint devices using methods approved by the restraint supplier required by the submittals for the component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

H. Attachment to Structure: Coordinate with structural componets.

I. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during

drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in conduit where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

B. Flexible connections to be supplied by restraint supplier.

3.5 FIELD QUALITY CONTROL

A. Provide independent 3rd party inspection of seismic installation in accordance with applicable sections of IBC and ASCE 7.Provide written report documenting findings prepared, submitted and signed by a registered professional engineer.

B. Inspections:

1. Verify isolator restraint clearance.
2. Verify snubber minimum clearances.
3. Verify ten percent of all cable restraints to ensure the angle of the restraints is installed properly.
4. Verify ten percent of all hanger rod locations where hanger rod stiffening is indicated in coordination drawings to ensure hanger rod stiffeners are installed properly.

3.6 ADJUSTING

A. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

B. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 26 05 49

SECTION 26 05 73

COORDINATION STUDY

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contractor shall engage the services of a qualified professional engineer to perform a short circuit and protective device coordination study and an arc flash hazard analysis. The Contractor is responsible for providing all pertinent information required by the preparers to complete the study. The study shall be performed in strict accordance with these specifications.

B. The study shall include all portions of the electrical distribution system from the utility overcurrent device down to and including all generators, enclosed circuit breakers, disconnects, panelboards, starters and automatic transfer switches.

PART 2 - PRODUCTS

2.1 SHORT CIRCUIT STUDY

A. The Contractor shall provide a short circuit study for the electrical distribution system. The study shall include the calculation of three phase bolted fault values and phase to ground fault values at every point of application of a protective device on the system. Momentary and interrupting duty values shall be calculated.

B. The short circuit calculations shall be performed by a computer program. Provide a computer generated single line diagram showing calculated and rated fault levels for each piece of electrical equipment.

C. The short circuit study report must include a complete index of fault bus identifications. A system diagram indicating system configuration and the fault bus locations shall be provided in the study.

D. Provide a complete printout of the results of the calculations.

E. Momentary duty fault values shall be tabulated for both three phase and phase to ground faults including: bus identification, bus L-L voltage, symmetrical fault current values, symmetrical fault kVA values, and X/R ratio at each fault bus.

F. Interrupting duty fault values shall be tabulated for both three phase and phase to ground faults including: bus values, symmetrical fault kVA values, X/R ratio at each fault bus, asymmetry factor at each fault bus, and the associated asymmetrical fault value at the bus.

G. Manufacturer's published interrupting/withstand capabilities shall be compared to calculated fault current values to determine acceptability of each protective device installed on the system. A tabulation shall be provided detailing the comparison.

H. The short circuit study shall report any deficiencies in interrupting capabilities and include recommendations for correcting such deficiencies.

2.2 PROTECTIVE DEVICE COORDINATION STUDY

A. The Contractor shall provide a protective device coordination study for all protective devices installed on the electrical distribution system.

B. The coordination study shall begin with the first upstream utility protective device and continue down through the distribution system to the first device on each feeder which does not have adjustable trip characteristics.

C. Time-current coordination curve sheets shall be developed on log-log paper utilizing manufacturer's published time-current characteristics. Key coordination elements shall be plotted to demonstrate the level of coordination provided.

D. Transformer damage characteristics as specified in American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI and IEEE) guidelines and inrush points shall be plotted to demonstrate the level of protection provided. Cable insulation withstand curves shall also be plotted to demonstrate protection provided.

E. Each curve sheet shall have a single line diagram indicating the portion of the system being plotted.

F. Each curve sheet shall be accompanied by a detailed narrative explaining the coordination provided, and any compromises made between protection and selectivity.

G. The coordination study report shall provide complete tabulations of all protective devices, ratings and settings. Recommendations shall be provided to improve coordination where necessary.

2.3 ARC FLASH HAZARD ANALYSIS

A. Provide arc flash hazard calculations for all electrical distribution equipment identified in NEC Article 110.16, Flash Protection.

B. Provide arc flash hazard calculations per IEEE-1584. Calculations shall provide the flash protection boundary (ft.), arc flash hazard category and the required personnel protective equipment (PPE) for all electrical distribution system equipment included in the Arc Flash Hazard Analysis. Also provide incident energy level as calculated in analysis.

C. Provide an arc flash hazard warning label on all electrical distribution system equipment included in the Arc Flash Hazard Analysis. The label shall comply with ANSI Z535.4-1998, Product Safety Signs and Labels. The label shall include, but not be limited to, the flash protection boundary, flash hazard category, and required PPE.

PART 3 - EXECUTION

3.1 REPORT

A. The short circuit and coordination study shall be completed prior to releasing for manufacture of all switchboards, fused switches, panelboards, circuit breakers and other equipment with overcurrent protection.

B. Six (6) copies of a bound report shall be submitted for review and approval at the completion of the short circuit and coordination study. The report shall contain all of the items required by these specifications. The report must be submitted prior to the delivery of any distribution equipment submittals. Submittal reviews of distribution equipment shall be withheld until the report is received, reviewed, and approved.

C. Time-current coordination curve sheets may be reduced to 8-1/2 x 11 size for inclusion in the report. However, full size curve sheets shall be provided, not necessarily bound, with each copy of the report.

D. The Contractor shall warrant that errors and omissions in the study or report shall be corrected without charge to the Owner when so found within twelve (12) months from acceptance of the first report.

E. Copies of the approved study shall be included in the manuals specified in Division-26 Section, “Basic Electrical Materials and Methods.”

F. Engage the services of a third party full NETA member testing agency to set any adjustable overcurrent devices in accordance with study recommendations.

END OF SECTION 26 05 73

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for commissioning the electrical system and its subsystems and equipment.

B. Related Sections include the following:

1. Section 019113 "General Commissioning Requirements"

C. The following systems and/or equipment shall be commissioned.
1. Interior Lighting and associated controls.
2. Electric Hot Water Heaters

1.2 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the Commissioning Agent (CA).

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in lighting systems, domestic hot water system, assemblies, equipment, and component maintenance orientation and inspection as directed by the CA.

E. Provide information requested by the CA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.3 COMMISSIONING AGENT'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for actual lighting systems, domestic hot water system, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.4 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.

2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

3. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
4. Certificate of readiness certifying that lighting systems, subsystems, equipment, and associated controls are ready for testing.
5. Test and inspection reports and certificates.
6. Corrective action documents.
7. Verification of testing, adjusting, and balancing reports.

1.5 SUBMITTALS

A. The following submittals are in addition to those specified in Section 019113 "General Commissioning Requirements."

B. Testing Procedures: CA shall submit detailed testing plan, procedures, and checklists for each series of tests. Submittals shall include samples of data reporting sheets that will be part of the reports.

C. Certificate of Readiness: CA shall compile certificates of readiness from Contractor certifying that systems, subsystems, equipment, and associated controls are ready for testing.

D. Certificate of Completion of Installation, Prestart, and Startup: CA shall certify that installation, prestart, and startup activities have been completed.

E. Test and Inspection Reports: CA shall compile and submit test and inspection reports and certificates, and shall include them in systems manual and commissioning report.

F. Corrective Action Documents: CA shall submit corrective action documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Prerequisites for Testing:

1. Certify that interior lighting systems and controls have been completed, calibrated, and started; are operating according to the Contract Documents; and that Certificates of Readiness are signed and submitted.
2. Certify that lighting instrumentation and control systems have been completed and calibrated; are operating according to the Contract Documents; and that pretest set points have been recorded.
3. Test systems and intersystem performance after approval of test checklists for systems, subsystems, and equipment.
4. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shut down, normal auto position, normal manual position, and unoccupied cycle).
5. Annotate checklist or data sheet when a deficiency is observed.

6. Verify proper responses of monitoring and control system controllers and sensors to include the following:

    a. For each controller or sensor, record the indicated monitoring and control system reading and the test instrument reading. If initial test indicates that the test reading is outside of the control range of the installed device, check calibration of the installed device and adjust as required. Retest malfunctioning devices and record results on checklist or data sheet.
    b. Report deficiencies and prepare an issue log entry.

3.2 TESTING

A. Test interior lighting systems performance after test checklists for systems, subsystems, and equipment have been approved.

B. Perform tests using design conditions whenever possible.

1. Simulate conditions by imposing an artificial load when it is not practical to test under design conditions and when written approval for simulated conditions is received from CA. Before simulating conditions, calibrate testing instruments. Set and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

C. Scope of Electrical Contractor Testing:

1. Testing scope shall include interior lighting systems and electric water heating systems associated with service hot water systems

D. Detailed Testing Procedures: CA, with Electrical Contractor shall prepare detailed testing plans, procedures, and checklists for lighting systems, and equipment.

E. Deferred Testing:

1. If tests cannot be completed because of a deficiency outside the scope of the electrical system, the deficiency shall be documented and reported to Owner. Deficiencies shall be resolved and corrected by appropriate parties and test rescheduled.
2. If the testing plan indicates specific seasonal testing, appropriate initial performance tests shall be completed and documented and additional tests scheduled.

F.Testing Reports:

1. Reports shall include measured data, data sheets, and a comprehensive summary describing the operation of systems at the time of testing.
2. Include data sheets for each lighting systems to verify proper operation of the electrical systems, the system it serves, the service it provides, and its location. Provide space for testing personnel to sign off on each data sheet.
3. Prepare a preliminary test report. Deficiencies will be evaluated by Architect to determine corrective action. Deficiencies shall be corrected and test repeated.

END OF SECTION 26 08 00

SECTION 26 09 43

LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The following specifications detail the minimum performance and related criteria for a lighting control system proposed for this project.

1.2 RELATED SECTIONS

A. Division-26 Section, Wiring Devices.

B. Division-26 Section, Lamps and Ballasts.

1.3 SYSTEM DESCRIPTION

A. Systems shall consist of factory pre-assembled interior lighting control systems as shown on the Drawings. These systems include, but are not limited to, occupancy sensors, on/off room controllers, plug load room controllers, wall switches, photo sensors, and emergency lighting control units as shown on the Drawings. All system layout, control, and sequence of operations shall be as shown on Drawings.

1.4 SUBMITTALS

A. Shall include a load schedule which indicates the actual connected load and load type per circuit, circuits and their respective control zones, circuits that are on emergency (if applicable), and the capacity, phase, and corresponding circuit numbers (per the electrical drawings).

B. Shall include a complete schematic of the system.

C. Shall include catalog cut sheets with performance specifications including historical testing data demonstrating complete compliance to all of the specifications herein.

D. Shall include written certification of compatibility of all lighting controls.

E. Shall include all exceptions taken to the specification.

F. Manufacturer shall provide any additional information or factory demonstrations as required by the specifier to demonstrate conformance with Part 2 of this specification. All demonstrations are to be at a location, time and in a manner chosen by the specifier.

G. Shall include project specific engineered drawings from the lighting control system manufacturer showing project specific device layouts, wiring diagrams and written sequence of operation for all individual rooms/areas of the building.

H. Lighting control system devices shall be coordinated with project specific light fixtures. Provide a letter/statement in the lighting control submittal that confirms that all lighting control system devices have been coordinated with the specific light fixtures that will be used on this project.

I. Manufacturer Seismic Qualification Certification: Submit certification that lighting control systems, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of ten (10) years continuous experience in the manufacturing of lighting controls.

B. Lighting control system shall be UL listed specifically for the required loads (i.e. incandescent, magnetic and electronic low voltage, fluorescent, etc.). Manufacturer shall provide evidence of compliance on request.

1.6 PROJECT/SITE CONDITIONS

A. Lighting control system shall operate in an ambient temperature range of 0˚C (32˚F) to 40˚C (104˚F) and 90% non-condensing relative humidity without the requirement of a regularly scheduled maintenance program for air filtration components.

1.7 WARRANTY

A. Manufacturer shall provide a full two (2) year warranty. The warranty shall cover 100% of the cost to repair or replace any parts required over the first two (2) years, which are directly attributable to the manufacturer.

1.8 COMMISSIONING

A. The contractor shall provide the manufacturer with ten (10) working day's notice of the scheduled commissioning date.

B. Upon completion of the installation, the system shall be completely commissioned by a factory-employed engineer. The check-out will be performed after all loads have been tested live for continuity and freedom from defects and that all control wiring has been connected and checked for proper continuity. The factory-employed engineer shall demonstrate and educate the owner's representative(s) on the system capabilities, operation and maintenance. The factory-employed engineer shall provide all devices, programming and initialization for all devices. Programming shall be in the field and shall be coordinated with the contractor.

C. Manufacturer shall offer extended warranty based upon successful factory commissioning.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Basis of Design: nLight (sensor switch)

2.2 GENERAL

A. All lighting system control components shall be provided by one manufacturer.

B. All lighting system components shall provide the same ratings, functional operation, and connection requirements, as the Basis of Design components as shown on the Drawings.

C. All lighting control system components shall be capable of connecting to other systems as shown on the Drawings.

D. All lighting control system components used to operate emergency light(s) shall be properly listed and labeled for this application.

E. All lighting control system components shall be UL listed and labeled.

2.3 WALLBOX PRESET CONTROLS, DIMMERS, SWITCHES AND WIRING DEVICES

A. Refer to Division-26 Section, Wiring Devices for details.

2.4 OCCUPANT SENSORS

A. All occupant sensors shall be provided by one manufacturer as part of the

lighting control system.

B. All occupant sensors shall be capable of central control by the lighting control system.

C. Occupant sensors shall incorporate ultrasonic motion sensing technology.

D. Occupant sensors shall incorporate adjustable sensitivity to cover various room sizes.

E. Wall Switch Occupant Sensors:

1. Wall switch occupant sensors shall be capable of controlling 6.7 amps at 120 volts or 4.3 amps at 277 volts.
2. Wall switch occupant sensors shall detect minor hand motion in rooms up to 300 square feet.
3. Wall switch occupant sensors shall provide the option for automatic or manual on and off control.

F. Ceiling-Mounted Occupant Sensors:

1. Ceiling-mounted occupant sensors shall be capable of controlling 16 amps at 120 volts or 277 volts with power-pack relay.
2. One-way ceiling-mounted occupant sensors shall detect minor hand motion in rooms up to 575 square feet. Two-way ceiling-mounted occupant sensors shall detect minor hand motion in rooms up to 1345 square feet.
3. Ceiling-mounted occupant sensors shall provide automatic on and off control.
4. Ceiling-mounted occupant sensors shall have Teflon insulated wires that are fire-rated for mounting in ceiling plenums.

2.5 HANDHELD PROGRAMMER(S)

A. Handheld programmer shall provide the ability to change intensity and fade time for each zone in the Lighting Control System without the use of a PC. Unit shall provide current light level indication and a thumbwheel for light level adjustment. Unit shall have a zone finder button for easy identification of the zone being programmed. Unit shall be equipped with a 25' (76.2m) cord.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment shall be installed utilizing manufacturer's catalogue cut sheets and installation instructions and in accordance with these specifications.

B. Contractor shall furnish all equipment, labor, system setup and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein. System setup shall include all device programming and initialization. Coordinate with factory-employed engineer.

C. Contractor shall include time to assist the factory-employed engineer during all start-up, commissioning, and follow-up adjustments for all lighting system

components.

D. Lighting Control Systems shall be installed in accordance with manufacturer's recommendations and in accordance with project seismic requirements. Refer to Division 26 Section "Seismic and Wind Controls for Electrical Systems and Equipment' for additional information

E. Provide labor materials, tools and coordination required to support commissioning activities in accordance with Division 26 Section "Commissioning of Electrical Systems."

3.2 MANUFACTURER'S FIELD SERVICES

A. Upon completion of the installation, the system shall be completely commissioned by the lighting control system manufacturer factory-employed engineer. The check-out will be performed after all loads have been tested live for continuity and freedom from defects and that all control wiring has been connected and checked for proper continuity. The factory-employed engineer shall demonstrate and educate the owner's representative(s) on the system capabilities, operation and maintenance.

B. Manufacturer shall offer upgraded eight (8) year limited warranty based upon successful field commissioning. The warranty shall have a minimum two (2) year period that covers all parts and labor for repair.

C. Manufacturer shall provide toll-free technical support hotline twenty-four (24) hours per day, seven (7) days per week.

D. Manufacturer shall be capable of providing on-site service support within twenty-four (24) hours anywhere in the continental USA and within seventy-two (72) hours anywhere in the world, except where special visas are required.

E. The lighting control system manufacturer factory-employed engineer shall return to the site two (2) additional times after construction is completed for the purpose of adjusting the lighting control systems to meet the request of the Owner. Include two (2) days for each site visit (4 days total) to occur within one (1) year after substantial completion.

END OF SECTION 26 09 43

SECTION 26 22 00

TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, “Basic Electrical Materials and Methods”, apply to this Section.

1.2 SUMMARY

A. Furnish and install general purpose and specialty dry type transformers as specified herein and as indicated on the Drawings.

1.3 SUBMITTALS

A. Provide product data for each type and rating of transformer. Data shall include dimensional plans, sections, and wiring diagrams indicating factory and field wiring.

B. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.

1.4 QUALITY ASSURANCE

A. All transformers and the installation of all transformers shall comply with NFPA 70, National Electrical Code, and Maryland Energy Efficiency Standards Act (EESA), enacted into law on March 1, 2005.

B. Transformers provided under this section shall conform to applicable standards from UL and shall be listed and labeled by UL or a Nationally Recognized Testing Laboratory (NRTL).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - Subject to compliance with requirements, provide products by one of the following:

1. Square D (Basis of Design)
2. Eaton (Cutler Hammer)
3. GE

2.2 DISTRIBUTION TRANSFORMERS

A. Transformers shall be dry type, air cooled, designed for 60 Hz service, having ratings and characteristics as indicated on the Drawings. Ventilated and non-ventilated transformers shall be provided with UL listed enclosures.

B. Transformers rated below 30 KVA shall have 365˚F (185˚C) insulation system and shall be designed for 239˚F (115˚C) rise above a 104˚F (40˚C) ambient.

C. Transformers rated 30 KVA and larger shall have 428˚F (220˚C) insulation system and shall be designed for 302˚F (150˚C) rise above a 104˚F (40˚C) ambient.

D. Cores shall be fabricated from grain oriented, non-aging silicon steel.

E. Coils shall be continuous without splices. Terminations shall be brazed or welded. Shielded transformers shall incorporate an electrostatic shield located between primary and secondary windings.

F. Core and coil assemblies shall be dried, impregnated with varnish or epoxy, and cured to minimize hot spots and reduce noise.

G. Transformers rated 30 KVA and larger shall have two (2) above normal full capacity 2-1/2 percent taps and four (4) below normal full capacity 2-1/2 percent taps. Taps shall be readily accessible and shall be set in the field.

H. Transformers shall be quiet type, which operate at sound levels below ANSI Standard C89-2. Core and coil assemblies shall be mounted on rubber vibration isolators.

I. Enclosures shall be cleaned and degreased, primed and finished to provide a scratch resistant and weather resistant finish.

J. Energy Efficiency for Transformers Rated 15 kVA and Larger:

1. Complying with NEMA TP 1, Class 1 efficiency levels.
2. Tested according to NEMA TP 2.

K. Conductor material shall be copper.

2.3 LOW TEMPERATURE RISE TRANSFORMERS

A. Low temperature rise transformers shall be furnished and installed where indicated on the Drawings.

B. Low temperature rise transformers shall conform with the requirements of this Section except as modified herein.

C. The temperature rise shall not exceed 176˚F (80˚C) above a 24 hour average ambient temperature of 86˚F (30˚C) when loaded at the rated KVA.

D. The transformer shall be capable of providing 30 percent additional capacity continuously without exceeding 302˚F (150˚C) rise and shall maintain a life expectancy of 20-25 years.

E. Lower temperature rise shall not be achieved by forced air cooling or by over-ventilating the coil.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Transformers shall be located to provide adequate circulation of cooling air and shall be installed in accordance with the manufacturer's written instructions.

B. Tighten all connectors and terminations in accordance with the manufacturer's published torque-tightening values.

C. Transformers shall be grounded in accordance with NFPA 70, National Electrical Code.

D. Adjust and set taps to provide optimum voltage for utilization equipment taking into account high and low voltage swings, load changes and voltage drop.

E. Provide supports and vibration isolators in accordance with Division-26 section, “Supporting Devices.”

F. Transformers shall be installed in accordance with manufacturer’s recommendations and in accordance with project seismic requirements. Refer to Division 26 section “Seismic and Wind Controls for Electrical Systems and Equipment” for additional information.

END OF SECTION 26 22 00

SECTION 26 24 13

SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

A. Provide switchboards in accordance with the plans, elevations, schedules and notes on the Drawings and as specified herein.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

1.4 SUBMITTALS

A. Submit manufacturer's data sheets, wiring schematics and installation dimensional drawings for Owner/Engineer review, comments, and/or approval.

B. Identify all specified items on submittals to assure compliance and ease of review and/or approval.

C. Prior to final test and acceptance, submit four (4) complete sets of final data sheets, schematics and dimensional drawings in neat brochure form.

D. Submittal data required:

1. Dimensioned plan view of all equipment.
2. Size and weight of individual shipping units.
3. Complete diagrams of all control and power connections.
4. Time - current characteristic curves shall be provided for all overcurrent devices and solid state trip devices. Curves shall be provided on standard 11 x 17 log-log sheets.

E. Manufacturer Seismic Qualification Certification: Submit certification that switchboards, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

    a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

A. All work and materials shall conform with the requirements of NFPA 70, "National Electrical Code", the requirements of the local authority having jurisdiction, and where applicable the requirements of BOCA.

B. All materials and assemblies shall be listed and labeled by UL.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - Subject to compliance with requirements, provide products by one of the following:

1. Square D (Basis of Design)
2. Eaton (Cutler Hammer)
3. GE

2.2 SWITCHBOARD

A. The switchboard shall be dead-front, freestanding front accessible (capable of being installed with the back of the switchboard directly up against a back wall), NEMA 1 indoor construction with the required number of vertical sections to fulfill the requirements for utility metering, a main disconnect, and feeder and branch circuit distribution.

B. Vertical sections shall be bolted together to form a rigid switchboard. Overall dimensions and shipping splits shall be arranged to comply with the dimensions indicated on the drawings and with the available access to the Electrical Equipment Rooms.

C. The switchboard shall include all the protective devices with all required accessories, instrumentation, and control devices as indicated on the Drawings and specified herein.

D. Readily accessible terminal blocks shall be provided for all control wiring leaving the switchboard and for all accessories furnished for customer use.

E. The sides, top and rear shall be covered with removable screw-on steel plates having formed edges.

F. The bus shall be silver plated copper of sufficient size and cross-section to limit the temperature rise to 149 degrees F (65 degrees C) based on UL tests. The bus shall be adequately braced and supported to withstand the mechanical forces exerted during short-circuit conditions when directly connected to a power source having the specified available short-circuit current.

G. A full capacity neutral bus shall be provided in all sections. Neutral lugs shall be provided for all four-wire circuits.

H. A ground bus shall extend the full length of the switchboard and shall be secured in each section. Ground lugs shall be provided for all circuits.

I. Switchboard shall be provided with adequate lifting means and shall be capable of being rolled or moved into position and bolted directly to the floor without the use of floor sills.

J. All vertical sections of the switchboard shall be aligned front and rear.

K. All exterior and interior steel surfaces shall be cleaned and treated with a rust-inhibiting phosphatized coating and then finished with baked enamel conforming to ANSI-61 light gray.

L. Bus shall be arranged A-B-C left-to-right, top-to-bottom, front-to-rear.

M. Switchboard ratings shall be based on an ambient temperature of 104 degrees F (40 degrees C).

N. The main device shall be individually mounted, stationary, completely isolated from the feeder devices. All connections to the main device shall be front accessible.

O. The feeder devices shall be group mounted, front accessible.

P. Switchboard construction shall permit maintenance of incoming line terminations, main device connections, all bus bolted connections and feeder device line and load connections to be performed from the front of the switchboard.

Q. The main device section shall have a UL service entrance label.

R. Phenolic nameplates shall be provided for all compartments, sections and circuit protective devices.

S. Fabricate enclosure with removable, hinged trim for front access to interior of switchboard. Also, provide hinged, rear cover panels where rear access is required.

T. Provide digital metering complete with all required metering transformers and protective devices to provide the following parameters:

Metered Values	Accuracy

AC Ampere		± 0.5%
Phase A		
Phase B		
Phase C		
AC Voltage		± 0.5%
Phase A-B	Phase A	
Phase B-C	Phase B	
Phase C-A	Phase C	
Watts		± 1.0%
VARS		± 1.0%
VA		± 1.0%
Watt-Hours		± 1.0%
VAR-Hours		± 1.0%
VA-Hours		± 1.0%
Power Factor		- 2.0%
Metered Values		Accuracy
Frequency		± 0.1 HZ
% THD		± 1.0%

2.3 CIRCUIT BREAKERS

A. The main device shall be a 100% rated circuit breaker with stored energy contact operation and ambient insensitive solid state trip device with the following functions:

1. Adjustable pickup and longtime delay.
2. Adjustable short-time pickup and delay with I2T function.
3. Adjustable ground fault pickup and delay.
4. Adjustable instantaneous pickup.
5. Trip indicating targets for overload, short circuit, and ground fault.
6. Short circuit rating: As shown on the Drawings.

B. The feeder devices shall be molded case circuit breakers of quick-make, quick-break, trip-free thermal magnetic type with frame, trip and voltage ratings, number of poles, and interrupting capacity as indicated on the Drawings and in the schedules. All breakers shall be removable from the front of the switchboard without requiring removal of adjacent units.

C. The switchboard shall have space or provisions for future units as indicated on the Drawings and in the schedules. Spaces shall include all necessary bus, device mounting supports, and connections requiring only the addition of the circuit breaker.

D. The main and feeder circuit breakers shall be equipped with suitable lugs as required for the conductors specified on the Drawings.

E. The main breaker shall be equipped with a bell alarm contact and two (2) normally open and two (2) normally closed auxiliary contacts.

2.4 UTILITY METERING

A. A utility service entrance section shall be provided to isolate incoming

underground service conductors from the remainder of the switchboard.

B. The service entrance section shall have a metering compartment which shall comply in all respects with the requirements of the utility company.

C. The metering compartment shall be provided with all lugs, bus, metering transformers, mounting devices and metering devices in accordance with utility specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install switchboards in the locations shown on the Drawings in accordance with manufacturer's written instructions and in accordance with standard accepted practices.

B. Repair any damage to the enclosure by sanding smooth the damaged area and repainting the entire section. Paint used to repair any enclosure surfaces shall be provided by the manufacturer of the switchboard and shall match the original finish of the switchboard.

C. Tighten connections and terminations in accordance with manufacturer's published torque tightening values. When manufacturer's values are not established, torque tighten all connections in accordance with UL 486A, UL 486B, and the National Electrical Code.

D. Switchboards shall be installed in accordance with manufacturer’s recommendations and in accordance with project seismic requirements. Refer to Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment’ for additional information.

E. Provide labor, materials, tools and coordination required to support commissioning activities in accordance with Division 26 Section “Commissioning of Electrical Systems.”

3.2 GROUNDING

A. Provide equipment grounding connections for switchboards in accordance with the National Electrical Code and the Drawings.

3.3 TESTING

A. After installation, check all terminations and connections for tightness and continuity.

B. Energize the switchboard and demonstrate opening and closing operation of all overcurrent protective devices.

C. All adjustable circuit breakers and protective relays shall be checked, tested and set by an independent Nationally Recognized Testing Lab (NRTL) in accordance with NETA specifications, the manufacturer's written instructions and Division-26

Section, Inspections, Testing and Start-up".

D. All protective devices shall be set in accordance with the approved coordination study. Copies of a certified test report shall be provided in accordance with Division-26 Section, "Inspections, Testing and Start-up" of these specifications.

END OF SECTION 26 24 13

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

B. Cabinets and enclosures shall conform to Division-26 Section, Boxes, Fittings and Cabinets.

1.2 SUMMARY

A. Furnish and install panelboards, cabinets and boxes as indicated on the Drawings and as specified herein.

1.3 SUBMITTALS

A. Provide product data for all panelboards, enclosures, cabinets, overcurrent devices and accessories.

B. Provide time-current-characteristic curves for all phase overcurrent devices rated 100 amperes or more and for all ground fault protective devices.

C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.

1.4 QUALITY ASSURANCE

A. Panelboards shall be supplied and installed in strict conformance with NFPA 70, National Electrical Code.

B. Products supplied under this Section shall comply with applicable requirements of UL standards pertaining to panelboards, overcurrent devices, enclosures, and cabinets. Completed assemblies shall be UL listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - Subject to compliance with requirements, provide products by one of the following:

1. Square D (Basis of Design)
2. Eaton (Cutler Hammer)
3. GE

2.2 PANELBOARDS

A. Panels shall be of the circuit breaker type, and shall have capacity and arrangement as shown on the panel schedules or one-line diagram.

B. Branch circuit breakers shall be bolt-on type and shall be of the ambient compensated, thermal magnetic type, which will provide inverse time delay overload, and instantaneous short circuit protection. Branch circuit breakers shall have one, two or three poles as designated on the panel schedule. No circuit breakers utilizing handle ties for two or three pole operation shall be acceptable. Voltage and current ratings shall be as indicated on the drawings.

C. Refer to panel schedules on drawings for exact circuit breaker arrangements and interrupting capacities. Provide circuit breakers UL listed as type HACR for air conditioning equipment branch circuits.

D. Main breakers and branch breakers shall have the same minimum ampere interrupting capacity. Series rating shall not be acceptable.

E. Provide a typewritten directory for each panel, placed inside the panel door. The directory shall list all rooms served by each breaker, using the "Owner's" room numbers. Directories shall be installed in a metal directory frame under glass or minimum 0.03 (.75 mm) inch thick clear non-yellowing plastic. Spares and spaces shall be written in pencil.

F. All circuit breakers which serve time clocks, telephone and communication equipment, refrigerators, exit signs, emergency circuits, fire alarm, security, and other miscellaneous control devices shall be equipped with mechanical handle locking devices.

G. Where panels contain contactors, the contactors shall be mounted behind a hinged, locking door. Contactor section shall be below the circuit breaker section unless otherwise noted. Provide all required barriers. Contactors shall conform to the requirements of Division-26 Section, Disconnects, Switches and Contactors.

H. Each panel shall be equipped with a ground bus, adequate for feeder and branch circuit equipment grounding conductors; bonded to box.

I. Each panel and cabinet and the units comprising same shall bear the manufacturer's nameplate and the UL label. Panelboards used for service entrance equipment shall be UL Service Entrance rated/labeled.

J. All single-phase, three-wire and three-phase, four-wire panels shall be equipped with a fully rated neutral bar. The neutral bar shall be sized to accommodate oversized neutral conductors where oversized neutral conductors are indicated on the Drawings.

K. All bus shall be copper.

L. Cabinet and trim shall be of code gauge steel (minimum) with 4" (100 mm) (minimum) wiring gutter all around. All panelboards shall be equipped with a hinged, locking door and hinged trim. Two (2) keys shall be furnished with each cabinet, and all locks on all cabinets shall be keyed alike. Provide door-in-door panel cover with piano hinge.

M. Where panels occur adjacent to one another in finished spaces, cabinets and doors for each panel shall be of the same height.

N. Panelboards shall be painted with gray over rust preventive primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount panels in locations shown, making sure that code-required clearances exist.

B. Where cabinets cannot be set fully flush due to shallowness of partition, trim protruding sides with approved metal or hardwood molding, fastened to cabinet so as to conceal intersection of wall and cabinet.

C. If paint is damaged during shipping or installation, damaged portion shall be sanded smooth and entire panel repainted.

D. Provide five (5) spare 3/4" (19 mm) conduits stubbed into accessible ceiling spaces above and below each flush mounted panel.

E. Load Balancing: After substantial completion, but not more than 60 days after final acceptance, measure load balancing and make circuit changes.

1. Measure loads during periods of normal system loading (coordinate with Owner).
2. Perform load balancing circuit changes outside normal occupancy/working schedule of the Owner at time directed by Owner’s representative.
3. After circuit changes are completed, recheck loads during normal load period. Record all load readings before and after changes and submit test results.

4. Tolerance: Difference exceeding 20 percent between phases within a panelboard is not acceptable. Rebalance and recheck as necessary to meet this requirement.

F. Panelboards shall be installed in accordance with manufacturer's recommendations and in accordance with project seismic requirements. Refer to Division 26 section" Seismic and Wind Controls for Electrical Systems and Equipment' for additional information.

END OF SECTION 26 24 16

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, “Basic Electrical Materials and Methods”, apply to this Section.

B. The requirements for outlet boxes and device enclosures are provided in Division-26 Section, “Boxes, Fittings and Cabinets”.

1.2 SUMMARY

A. The Contractor shall furnish and install all wiring devices indicated on the Drawings or specified herein.

1.3 SUBMITTALS

A. Provide product data for each type of wiring device specified.

B. Manufacturer Seismic Qualification Certification: Submit certification that wiring devices, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

   a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.

1.4 QUALITY ASSURANCE

A. All products and the installation of all products shall comply with NFPA 70, "National Electrical Code."

B. Wiring devices shall be listed and labeled by UL and shall confirm to the latest UL and NEMA standards pertaining to wiring devices.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

A. All wiring devices shall be Specification Grade.

B. Wiring devices shall be black in color unless otherwise indicated.

C. Convenience receptacles shall be duplex, grounding type, 20A, 2P, 3W, 125V, NEMA 5-20R, straight blade, nylon or high-strength thermoplastic material.

D. Safety receptacles (tamper-resistant) shall be flush, specification grade, grounding type, 20A, 2P, 3W, 125VAC, NEMA 5-20R, straight blade, nylon or high-strength thermoplastic material unless indicated as special purpose outlet. Receptacles shall be designed to accept standard two-wire parallel connector caps and shall grip both sides of the connector wire. Receptacles shall utilize dual shutter system to prevent insertion of foreign objects.

E. Convenience receptacles serving commercial kitchens (15 and 20 ampere branch circuits), bathrooms, toilets, garages, piers, pools, fountains, outdoor and wet locations, and construction sites shall be of the ground fault interrupter type, duplex, grounding type, 20A, 2P, 3W, 125V, NEMA 5-20R, straight blade, nylon or high-strength thermoplastic material.

F. Convenience receptacles located in wet locations shall be of the ground fault interrupter, weather resistant type, duplex, grounding type, 20A, 2P, 3W, 125V, NEMA 5-20R, straight blade, nylon or high-strength thermoplastic, corrosion resistant material.

G. Transient voltage surge suppressor (TVSS) receptacles shall provide equal surge protection of not less than 80 joules for phase-to-neutral, phase-to-ground and neutral-to-ground protection. The TVSS receptacle shall provide an average of 7:1 EMI and RFI noise reduction from 500 kHz to 30 mHz. TVSS receptacles shall be duplex, grounding type 20A, 2P, 3 W, 125V, NEMA 5-20R, straight blade, nylon material.

H. Clock receptacles shall be single, grounding and hanger type, 15A, 2P, 3W, 125V, NEMA 5-15R, straight blade, nylon or high-strength thermoplastic material with stainless steel plate.

I. Single throw toggle switches shall be quiet type rated 20A, 1P, 120/277 VAC.

J. Single throw lighted toggle switches shall be quiet type rated 20A, 1P, 120/277 VAC, illuminated red polycarbonate handle. Handle shall glow when switch is on.

K. Key operated light switches shall be rated 20A, 1P, 120/277 VAC, gray toggle cover, with two (2) keys furnished for each switch. All switches shall operate from the same key.

L. Three-way toggle switches shall be quiet type rated 20A, 120/277 VAC. Switches shall be positive-action type and shall not permit a maintained neutral position.

M. Four-way toggle switches shall be quiet type 20A, 120/277 VAC. Switches shall be positive-action type and shall not permit a maintained neutral position.

N. Photo control relays shall be as specified in Division-26 Section, Lighting Fixtures.

O. Wall plates for switches, receptacles, etc. in indoor dry areas, shall be satin finish stainless steel Type 302 for concealed raceways; and zinc-coated sheet steel or cast metal having round or beveled edges, for exposed raceways. Install galvanized steel wall plates in unfinished spaces. Wall plates for receptacles supplied by the generator emergency system shall be metallic with a matt red finish.

P. Patient Care Areas:

1. All receptacles shall be hospital grade type receptacles.
2. All receptacles installed in areas or rooms classified as "Patient Care Areas" shall be hospital grade type receptacles. Refer to NEC Article 517 and the contract drawings for identification of patient care areas.

Q. Wallbox Dimmers and Switches:

1. All devices shall be UL listed specifically for the required loads (i.e., incandescent, fluorescent, low voltage, electronic low voltage). Manufacturer shall provide file card upon request. Universal dimmers shall not be acceptable.
2. All dimmers and switches shall incorporate an air gap, which shall be accessible without removing the faceplate. The air gap switch shall be capable of meeting all applicable requirements of UL 20 and UL 1472 for air gap switches in incandescent dimmers.
3. All dimmers and switches shall provide power failure memory. Should power be interrupted and subsequently returned, the lights will come back on to the same levels set prior to the power interruption. Restoration to some other default level is not acceptable.
4. Dimmers and switches shall meet ANSI/IEEE Standard C62.41-1980, tested to withstand voltage surges of up to 6000V and current surges of up to 200A without damage.
5. Dimmers and switches shall meet the UL 20 and UL 1472 limited short circuit test requirement for snap switches.
6. Dimmer control shall be linear slide. Dimmer shall provide a smooth and continuous Square Law dimming curve.
7. Dimmer shall be voltage regulated so that a +10% variation in line voltage shall cause not more than a +5% variation in load voltage when dimmer is operating at 40V (5% light output).
8. Dimmers shall utilize a LC filter network to minimize interference with properly installed radio, audio and video equipment.
9. Dimmer control slider shall be captured.
10. Faceplate shall snap onto device with no visible means of attachment. Heat fins shall not be visible on front of device. At locations with multiple devices, one (1) seamless, multi-gang faceplate shall be provided. Contractor is responsible for coordination of proper backbox size and faceplate type.
11. Dimmers, switches and faceplates shall be Lutron Nova T style, or approved equivalent. This shall be specifically coordinated with the light fixture being controlled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other work, including painting and installation of electrical boxes and wiring.

C. Install wiring devices only in electrical boxes which are clean; free from building materials, dirt, and debris.

D. Install wiring devices after wiring work is completed.

E. Install wallplates after painting work is completed.

F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A. Use properly scaled torque indicating hand tool.

G. Protect installed components from damage. Replace damaged items prior to final acceptance.

H. Provide weatherproof, in-use covers for all receptacles located in wet locations per NEC 406.8.

I. Wiring Devices shall be installed in accordance with manufacturer’s recommendations and in accordance with project seismic requirements. Refer to Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment’ for additional information.

3.2 TESTING

A. Prior to energizing circuits, test wiring for electrical continuity and short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six (6) times.

B. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

END OF SECTION 26 27 26

SECTION 26 27 36

ELECTRICAL CONNECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, “Basic Electrical Materials and Methods”, apply to this Section.

1.2 SUMMARY

A. The Contractor shall provide electrical connections to and between all equipment indicated on the Drawings and Schedules and in the Specifications.

B. Electrical connections shall be provided for, but not limited to, electrical heaters; lighting fixtures; motors; motor starters and controllers; electrical distribution equipment; converters, rectifiers, transformers, and inverters; and communication, computer, clock, intercom, telephone, security, fire alarm and video systems.

C. Unless otherwise specified, the Contractor shall, under this Section, mount and align all starters, control devices, safety switches and other related equipment whether specified in this or other Sections of the specifications, except where such items are factory mounted on the driven equipment. The mounting and alignment of starters and control devices for the automatic temperature control system are included in the Sections in which the equipment is specified.

D. Unless otherwise specified, the Contractor shall, under this Section of the specifications, provide all wiring, including conduit, wire, junction boxes, disconnecting switches, overcurrent protection, etc., not specified elsewhere in this specification, to and between all motors, starters, control devices and related electrical equipment, whether specified in this or other Sections of this specification, except where such items are factory wired, as well as factory mounted on the driven equipment.

E. Wiring for the automatic temperature control system is specified in other Sections of the specification.

F. Unless otherwise specified, all wiring to motors, control equipment and related electrical equipment, shall be installed in conduits with flexible metal conduit connections utilized for final motor connections. Flexible conduits shall be large enough to accommodate motor feeder, ground conductors and control wires, whether or not so indicated on the drawings. Flexible conduits shall be limited to a maximum length of 6'-0" (1800 mm-0 mm).

G. The drawings are diagrammatic. It is imperative that the contractor obtain exact rough-in information for all equipment well in advance of actual installation to provide coordination for his and other trades.

1.3 SUBMITTALS

A. Submit product data for all materials and components used for electrical connections.

B. Manufacturer Seismic Qualification Certification: Submit certification that electrical connections, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.

1.4 QUALITY ASSURANCE

A. All materials and components and the installation of all materials and components shall comply with the requirements of the following standards:

1. NFPA 70 "National Electrical Code"
2. IEEE Standard 241 "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings"
3. Applicable standards of ANSI/IEEE and NEMA pertaining to the products and installation of products for electrical connections
4. UL Standard 486A "Wire Connectors and Soldering Lugs for Use with Copper Conductors"

B. All materials and components shall be listed and labeled by UL or ETL.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide all materials and components required for complete splices and terminations of all circuits. All wiring shall be spliced and terminated using lugs and/or terminal blocks, except as permitted elsewhere in these Specifications.

B. All splices in branch circuit wiring rated 600 volts and less, except as permitted elsewhere in these Specifications, shall be made using compression type lugs specifically designed for the type, size and rating of the conductor. The lugs shall be installed using a tool specifically designed for the purpose.

C. Splices in copper branch circuit wiring for sizes #12 and #10 AWG may be made with non-tool, pre-insulated, molded wire connectors with integral self-locking spring grip.

D. All terminations of feeders and branch circuit wiring rated 600 volts or less, except as noted elsewhere in these specifications, shall be made using mechanical clamp-type set-screw lugs. Lugs which incorporate direct contact between the set-screw and the conductor shall not be permitted.

E. Tapes:

1. Self-adhesive tapes shall be used to insulate conductor splices. Terminations shall be in conformance with the following standards:

   a. 600 Volts, Nominal and Less: UL 510, ASTM D-2754, ASTM D-3005, and ASTM D-4388.
   b. 600 Volts through 69 Kilo Volts: ASTM D-4388 and IEEE 48.

2. Vinyl plastic electrical tape shall be used for all terminations and splices of conductors for circuits of 600 volts nominal and less, except terminations in motor terminal boxes, transformer terminations, lighting and all heat producing equipment terminations. Terminations of the equipment listed herein shall be insulated with pressure sensitive glass cloth tape.
3. Tapes and high voltage splice and termination kits shall be the standard product of 3M Corporation, Plymouth Rubber Company, Inc. or approved equivalent.

F. Special lugs may be required to accommodate the size and number of conductors shown on the Drawings. The Contractor shall verify lug requirements for all circuit breakers and equipment terminals and shall provide correct lugs as required.

G. Pre-insulated solderless ring or spade type crimp connectors and terminals shall be used for all alarm and control circuits.

H. All connectors and terminals shall be of the proper size and ampacity, material and type for the application and service.

2.2 RACEWAYS AND FITTINGS

A. The Contractor shall provide raceways and fittings of the types, sizes, and finish indicated for each type of service. Where the type of raceway is not specified, the Contractor shall provide and install a raceway of proper selection as determined by the installer to fulfill the wiring and equipment connection requirements and comply with NEC requirements for raceways.

B. All raceways and fittings and the installation of all raceways and fittings shall comply with the requirements of these Specifications.

PART 3 - EXECUTION

3.1 INSPECTION

A. The Contractor shall inspect the area where electrical connections are to be installed. The installation of electrical connections shall not be permitted until site conditions are satisfactory.

3.2 INSTALLATION

A. The Contractor shall install all electrical connections in accordance with the manufacturer's written instructions using recognized industry practices.

B. Power, control, data, signal and communication circuits shall be connected to equipment in accordance with the manufacturer's wiring diagrams. The Contractor shall be fully responsible for the correct termination and interface of all electrical connections.

C. Splices shall be insulated with tape which provides an insulation rating which meets or exceeds the insulation rating of the conductor. All outdoor splices shall be made watertight using tapes and sealants specifically designed and listed for outdoor applications.

D. Wiring devices shall not be used as splices.

E. Electrical connections shall be tightened in accordance with equipment manufacturer's published torque tightening values. The installer shall use proper tools which shall include torque screwdriver, torque wrench, and ratchet wrench with adjustable torque settings.

F. UL Standard 486A torque tightening values shall be used when manufacturer's published tightening values are not available.

G. Electrical Connections shall be installed in accordance with manufacturer’s recommendations and in accordance with project seismic requirements. Refer to Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment’ for additional information.

3.3 TESTING

A. All electrical connections shall be tested to ensure electrical continuity and compliance with these Specifications.

B. The Contractor shall demonstrate to the Owner or Engineer that a random selection of electrical connections has been tightened in accordance with the manufacturer's published torque tightening values.

END OF SECTION 26 27 36

SECTION 26 28 16

DISCONNECTS, SWITCHES AND CONTACTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, “Basic Electrical Materials and Methods”, apply to this Section.

1.2 SUMMARY

A. The Contractor shall furnish and install circuit and motor disconnect switches, remote control switches and magnetic contactors where indicated on the Drawings and where required by the National Electrical Code, local codes and the authority having jurisdiction.

1.3 SUBMITTALS

A. Provide product data for each type and rating of circuit and motor disconnect switch.

B. Manufacturer Seismic Qualification Certification: Submit certification that disconnects, switches and contactors, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.

1.4 QUALITY ASSURANCE

A. Circuit disconnects and motor disconnect switches and the installation of same shall comply with the requirements of NFPA 70, "National Electrical Code."

B. Circuit and motor disconnect switches shall be listed and labeled by UL.

PART 2 - PRODUCTS

2.1 CIRCUIT AND MOTOR DISCONNECT SWITCHES

A. Switches shall be constructed in accordance with the latest editions and revisions of NEMA Standard KS-1, Federal Specification W-S-685C, and Underwriters' Laboratories Standard 98.

B. Switches shall be fusible or non-fusible as indicated on the Drawings, or as required by the equipment served, horse-power rated, quick-make, quick-break, heavy-duty type with integral arc suppressors. The handle shall be part of the enclosure, not the cover.

C. Fused switches and fuses shall have a minimum integrated interrupting rating of 100,000 amperes RMS symmetrical.

D. Switches 800 amperes and larger shall be bolted pressure type.

E. Switches used for service entrance shall be service rated and bear the UL service entrance label.

F. Switches shall have surface mounted NEMA type 1, 3R or 4X enclosures as indicated or required by locations. All enclosures shall be designed to permit padlocking in the "open/off" position unless noted otherwise. All switches shall be heavy duty type.

.

G. Switches on 120/208 volt service shall be rated 240 volts and switches on 277/480 volt service shall be rated 600 volts.

H. Fused switches for motor applications shall be furnished with UL listed dual-element Class RK-1 time delay fuses rated 600 volts. Fuse current ratings shall be as indicated on the Drawings or in accordance with the motor manufacturer's recommendations when specific sizes are not specified on the Drawings.

2.2 REMOTE CONTROL SWITCHES

A. Remote control switches shall be electrically operated, mechanically held. The main contacts shall be power driven to both the open and closed positions. Operating mechanisms which rely on gravity or permanent magnets shall not be used.

B. The contacts and operating mechanism shall be enclosed by an insulated cover. A safe manual operator shall be provided to either open or close the switch.

C. The main contacts shall be silver alloy composition and shall be protected by arcing contacts on sizes 600 amperes and above. Auxiliary contacts shall be rated 10A, 120 VAC. Provide one normally open and one normally closed auxiliary contact.

D. Contacts, power and control connections, coils, and arc chutes shall be accessible and serviceable from the front.

E. The remote control switches shall be rated in amperes for a total system load including motors, lighting ballasts, and resistive and tungsten filament lamp loads.

F. Remote control switches shall be individually enclosed or panelboard mounted as indicated on the drawings. Enclosures shall comply with the requirements of Division-26 Section, “Boxes, Fittings and Cabinets.”

G. Remote control switches shall have a UL listed withstand current rating equal to or exceeding the available short-circuit current at the location where the switch is to be installed.

H. The remote control switch shall be arranged for two-wire control from a maintained type control switch. All controls and modules, with the exception of the control switch, shall be located in the same enclosure with the remote control switch.

2.3 MAGNETIC CONTACTORS

A. Magnetic contactors shall be electrically operated, mechanically held.

B. The contacts and operating mechanism shall be enclosed by an insulated cover.

C. The main contacts shall be silver alloy composition and shall be protected by arcing contacts on sizes 600 amperes and above. Auxiliary contacts shall be rated 10A, 120 VAC. Provide one normally open and one normally closed auxiliary contact.

D. Contacts, power and control connections, coils, and arc chutes shall be accessible and serviceable from the front.

E. Contactors shall be rated in amperes for a total system load including motors, lighting ballasts, and resistive and tungsten filament lamp loads.

F. Contactors shall be individually enclosed or panelboard mounted as indicated on the Drawings. Enclosures shall comply with the requirements of Division-26 Section, “Boxes, Fittings and Cabinets.”

G. Contactors shall have a UL listed withstand current rating equal to or exceeding the available short-circuit current at the location where the switch is to be installed.

H. The contactor shall be arranged for two-wire control. All controls and modules, with the exception of control switches, push buttons and pilot lights shall be located in the same enclosure with the contactor.

2.4 CONTROLS

A. Push buttons shall be momentary contact, heavy duty, oiltight with legend plate. Buttons shall be fully guarded and shall be red in color.

B. Selector switches shall be two position, heavy duty, oiltight with legend plate.

C. Contact blocks shall be provided as required for all push buttons and switches. Contacts shall have a 10 ampere continuous current rating at 120 VAC or 120 VDC except where indicated otherwise.

D. Pilot lights shall be heavy duty, oiltight with legend plate. Pilot lights shall utilize incandescent lamps designed for high brightness applications. Lens shall be acrylic fresnel type of the color specified.

E. Control stations shall be recessed with sufficient space to accommodate operators as required. Provide stainless steel NEMA 1 flush cover plates.

F. Boiler emergency stop switches shall be guarded, red toggle-type, single pole, rated 30 amperes at 250 VAC. Switch shall be enclosed in a single gang outlet box with red coverplate and legend to read "EMERGENCY STOP". A nameplate shall be provided to indicate the equipment served. The electrical contractor shall route 3/4" conduit and control wires from each switch to boiler control panel. Coordinate wiring type and quantity with boiler manufacturer. Leave six (6) feet of slack within boiler control panel for final termination by ATC contractor. Coordinate connection point in boiler control panel with boiler manufacturer.

2.5 ACCESSORIES

A. Provide electrical interlocks where indicated on the Drawings.

B. Provide one normally open and one normally closed auxiliary contact on each switch. Auxiliary contacts shall be rated 10A, 120 VAC.

C. Fused disconnects and switches shall be provided with integral built-in fuse pullers arranged to facilitate fuse removal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Switches shall be coordinated with the equipment to provide switches to suit the particular equipment characteristics and requirements.

B. Provide fusible switches for all equipment labeled for and/or requiring fuse protection.

C. Switches shall be installed in accordance with manufacturer's published instructions.

C. Provide three (3) spare fuses of each type and rating furnished for this project. Deliver spare fuses to the Owner's place of storage.

E. Disconnects, Switches and Contactors shall be installed in accordance with manufacturer’s recommendations and in accordance with project seismic requirements. Refer to Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment’ for additional information.

3.2 TESTING

A. Prior to energizing circuits and switches, test wiring for electrical continuity and short-circuits.

END OF SECTION 26 28 16

SECTION 26 28 17

ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes molded-case circuit breakers in individual enclosures.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches

1.3 SUBMITTALS

A. Division-1 Section - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog sheets showing ratings, trip units, time current curves, dimensions, and enclosure details.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed circuit breakers, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - Subject to compliance with requirements, provide products by one of the following:

1. Square D (Basis of Design)
2. Eaton (Cutler Hammer)
3. GE

2.2 MOLDED CASE CIRCUIT BREAKER

A. Product Description: Enclosed, molded-case circuit breaker conforming to NEMA AB 1 with interrupting capacity to comply with available fault currents and as indicated on Drawings.

B. Accessories: Conform to NEMA AB 1 and as indicated on Drawings.

1. Shunt Trip Device
2. Auxiliary Switch
3. Electrical Operator
4. Handle Lock: Provisions for padlocking (NEMA 12 enclosure)
5. Grounding Lug: In each enclosure

C. Enclosed circuit breakers shall have general purpose, surface mounted, NEMA Type 1, 3R or 4X enclosure as indicated or required by location.

D. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit breaker frame sizes 250 A and larger.

E. Service Entrance: Enclosed circuit breakers identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

F. Circuit breakers shall be fully rated. Series rated withstand are prohibited.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed circuit breakers plumb. Provide supports in accordance with Division-26 Section, “Supporting Devices.”

B. Height: 5 feet (1500 mm) to operating handle.

C. Locate and install engraved plastic nameplates in accordance with Division-26 Section, “Basic Electrical Materials and Methods.”

D. Enclosed Circuit Breakers shall be installed in accordance with manufacturer’s recommendations and in accordance with project seismic requirements. Refer to Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment’ for additional information.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with National Electrical Testing Association (NETA).

END OF SECTION 26 28 17

SECTION 26 29 13

MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

A. Furnish and install motor controllers where indicated on the Drawings, where required by the Contract Specifications, and where required for the control and protection of motors as necessary for a complete installation.

1.3 SUBMITTALS

A. Submit shop drawings and product data for all motor controllers and motor control centers.

B. Submittals shall include equipment dimensions, power and control wiring diagrams, component descriptions, calculations where required and ratings, and a list of recommended spare parts.

C. Complete operating and maintenance manuals shall be provided which include technical data sheets, wiring diagrams and information for ordering replacement parts.

D. The manufacturer shall submit a copy of the specifications with each sub-paragraph noted with the term, "compliance", "deviation", or "alternate".

1. By noting the term "compliance" it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
2. By noting the term "deviation" it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
3. By noting the term "alternate" it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. Any alternate shall be fully described as to what the manufacturer proposes to provide.

E. Variable Frequency Drive (VFD) submittals shall be submitted under separate, stand-alone submittal package when VFD is provided by Division-23 as part of mechanical equipment.

F. Manufacturer Seismic Qualification Certification: Submit certification that VFDs and other motor controller equipment, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

    a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.

1.4 QUALITY ASSURANCE

A. Motor controller components and assemblies shall be furnished and installed in accordance with NFPA 70, National Electrical Code, and shall conform to the requirements of UL 845 and applicable sections of NEMA and ANSI/IEEE standards.

B. Motor controllers and motor control centers shall be listed and labeled by Underwriters' Laboratories or a Nationally Recognized Testing Laboratory (NRTL).

C. Source Limitations: Obtain Motor Controllers through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 FRACTIONAL HORSEPOWER STARTERS

A. Fractional horsepower manual starters shall be used for single phase motors except where indicated. Single phase starters shall provide across the line starting and overload protection. Single pole and double pole starters shall be used as required and shall be rated not less than 1 horsepower.

B. Single phase manual starters shall feature snap action double-break contacts, motor running indicating light and trip free melting alloy overload elements selected for the specific motor application.

C. Single phase manual starters located in mechanical and electrical rooms shall be installed in NEMA 1 general purpose enclosures. Starters located outdoors or in wet locations shall be installed in NEMA 4 watertight enclosures. Starters located in finished areas shall be installed in a flush outlet box and furnished with a stainless steel plate.

D. Manual motor starters shall be toggle-type and shall be arranged so they may be locked with a padlock in the OFF position.

E. Oil-tight hand-off-auto selector switches shall be provided where starters are controlled by automatic devices.

2.2 COMBINATION STARTERS

A. Combination motor starters shall be provided with an integral motor circuit protector specifically designed for motor applications. The MCP shall have a continuous current rating in accordance with NEC Article 430 and shall provide adjustable short-circuit trip settings. The MCP shall have a minimum short-circuit rating of 42,000 amperes at 480 volts.

B. An external operating handle for the MCP shall be provided. The handle shall clearly indicate the position of the MCP and shall be padlockable in the OFF or OPEN position. Interlocks shall be provided to prevent opening the door when the external operating handle is in the ON or CLOSED position. An interlock defeater shall be provided for use by authorized personnel.

C. Magnetic-type motor starters shall be used for single phase motors where indicated and for all three phase motors.

D. Starters shall be full voltage non-reversing (FVNR) or reduced voltage type as indicated on the Drawings. Starters shall utilize three temperature compensated bimetallic overload relays factory set for the specific motor application. Overload relays shall be field adjustable plus or minus 15 percent of the rated trip current. Solid state overload relays are acceptable.

E. Starters shall be furnished with the following accessories:

1. Hand-off-auto selector switch.
2. Green pilot light to indicate power available to the starter but motor not on.
3. Red pilot light to indicate motor running.
4. Transformer for 120 volt control power (fused primary and secondary).
5. Overload trip indicator and reset.
6. Coils rated 120 volts A.C.
7. Two (2) normally open and two (2) normally closed auxiliary contacts for customer use.

F. Reduced Voltage Starter:

1. Solid state starters shall be provided with Class 20 electronic overload and phase loss, current unbalance, undervoltage and overtemperature protection.

G. Starters shall be capable of withstanding the let-through short-circuit current of the protective device. Current limiters shall be provided when required to achieve adequate protection from high short-circuit currents.

H. Where the Drawings indicate individual enclosures for starters, the starters shall be provided in NEMA type 1 enclosures except when noted otherwise on the Drawings. Outdoor starters shall be in NEMA 3R enclosures.

I. Starters to be installed in motor control centers shall conform to these specifications and the section pertaining to motor control centers.

2.3 VARIABLE FREQUENCY DRIVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary (Basis of Design)
2. Yaskawa Electric America, Inc.
3. Toshiba International Corporation

B. Variable Frequency Drives (VFD) shall be of a Pulse Width Modulated (PWM) design with an input power factor greater than 0.95 at all operating speeds and loads. The VFD shall have an efficiency of 96% or greater at rated output.

C. The VFD shall be microprocessor based and utilize digital input for parameter adjustments. Use of potentiometers for parameter adjustment is not acceptable.

D. The VFD shall automatically attempt to restart after a malfunction or an interruption of power. The number of attempted restarts shall be customer selectable (0 to 5). If the drive reaches the limit of restarts without successfully restarting and running, restart circuit shall lockout.

E. A current limit circuit shall be provided to limit motor current to a preset adjustable maximum level by reducing the drive operating speed or acceleration rate when the limit is reached. Range of adjustment shall be from 50 to 110% of controller rated output.

F. The VFD shall include a digital display and digital input programming capability. The display shall be programmable for indication of output speed in rpm, frequency or percent of base speed; motor current (amperes) and output motor voltage. The display shall also function as a first fault indicator.

G. Upon receipt of N.O. "dry" contact closure, the VFD shall run at a preset (field adjustable) speed.

H. The VFD shall provide selection for Hand-Off-Auto control. In Hand mode, the motor shall be started and stopped from the operator’s panel. In the Auto mode, the motor shall be started and stopped by remote contact closure. In the Off mode, the motor shall be locked out. The Hand-Off-Auto control shall operate in both the VFD mode and the bypass mode.

I. The VFD shall provide selection for Manual ref/Auto ref. In the Man ref. mode, the VFD speed reference shall be set from the operators panel. In the Auto ref. mode, the VFD speed reference shall be set by the external source instrument signal.

J. The input signal follower circuit shall have selectable differential inputs and accept an electrical speed command from an external source rated at 4-20 mA or voltage signals of 0-10 Vdc.

K. Electronic motor protection shall be provided. The protection circuit shall provide orderly shutdown.

L. The VFD shall include a programmable 4-20 ma analog output which shall be capable of indicating output frequency, motor speed, output current, motor torque, motor power or motor voltage. The VFD shall include a minimum of two programmable digital outputs (form C relay contacts) capable of indicating drive run, drive fault, and drive ready. The VFD shall include an interface chip to provide open protocol capability for interface with the Energy Management/ATC system. Coordinate protocol with Energy Management/ATC manufacturer.

M. The VFD stopping mode functions shall be selectable for coast to rest or stopping at programmed deceleration rate.

N. In the event of loss of input follower reference signal (transducer failure), the VFD shall go to a preset speed which shall be user adjustable. The VFD shall provide a digital output signal (form C relay contact) to indicate the loss of reference condition.

O. The VFD shall operate within the following ratings and provide the following characteristics:

1. Output frequency range: 1-120 Hz.
2. Frequency resolution: 0.5% of base speed with analog input 0.025% with digital input.
3. Overload rating: 110% for one minute.
4. Input voltage: 480 V +/-10% or 208V +/- 10%. Coordinate with motors specified.
5. Minimum speed: 0 to 70%.
6. Maximum speed: 30 to 120%.
7. Linear accel: 1 to 300 seconds, time adjustable.
8. Linear decel: 1 to 300 seconds, time adjustable.
9. Maximum output voltage: adjustable.
10. Adjustable V/Hz with selectable profiles.
11. Operating temperature: 32 degrees F to 104 degrees F (0 degrees C to 40 degrees C).
12. Altitude: 3300 feet (1000 m).
13. Humidity: 95% non-condensing.
14. Minimum three frequency avoidance bands, field selectable.

P. VFD shall include a door interlocked circuit breaker which shall disconnect all input power.

Q. Provide a two (2) or three (3) contactor type bypass circuit that allows the VFD to be electrically isolated so that it can be worked on while the unit is operating in bypass mode. Provide a bypass circuit mounted integrally with the VFD. The bypass shall utilize an input circuit breaker to feed both the VFD and the bypass starter. An input contactor shall be utilized to feed the VFD and isolate the VFD for trouble shooting. An output contactor which is electrically and mechanically interlocked with the bypass starter shall be utilized on the VFD to provide a positive disconnect between the VFD and the motor. A VFD/bypass control switch shall be provided on the front of the VFD enclosure.

R. VFD and bypass circuit shall be provided in a NEMA 1 enclosure suitable for wall mounting or floor mounted as indicated.

S. The VFD power circuit shall be fused and isolated internally with respect to ground. Fuses shall be rated at 200,000A interrupting capacity. Phase loss protection shall be provided to prevent single phasing.

T. The VFD shall be capable of continued operation during an intermittent loss of power for 0.1 seconds (6 cycles). Opening of the VFD's input and/or output line switches while operating shall not result in damage to the power circuit components.

U. The VFD shall have an instantaneous electronic trip circuit to protect the VFD from output line-to-line and line-to-ground short circuits.

V. Transient and surge voltage protection shall be provided. The VFD shall withstand a 6000 volt, 80 joule surge voltage when tested in accordance with ANSI/IEEE C62.41-1980.

W. The VFD shall be able to start into a rotating motor (any speed or direction) and accelerate (decelerate) to set speed without tripping or component loss.

X. The Contractor shall submit calculations showing compliance with the following total harmonic distortion (THD) levels and total demand distortion (TDD) levels. Calculations shall assume the point of common coupling (PCC) to be the utility company transformer secondary.

	General System
THD (Voltage)	5%
TDD (Current)	8%

Harmonic trap filters are not acceptable and shall not be used to meet these requirements. The harmonic analysis shall include all harmonics to the 49th. VFD's greater than 6 pulse shall require a phase shifting transformer. External transformers shall not be required and will not be accepted. The VFD manufacturer shall provide the transformer integral to the VFD in a single UL listed enclosure.

Y. The maximum cable length between the VFD and the motor is 100 feet (30 m).

Z. Minimal VFD requirement per motor size shall be:

1. Motor rated size < 100 HP, provide 6 pulse VFD or greater with a 5% line reactor. A 3% load reactor is required when cable lengths exceed 100 feet between the VFD and the load.
2. Motor rated size ≥ 100 HP, provide 18 pulse VFD or greater.
3. A 6 pulse VFD with 5% line reactor and a harmonic mitigating filter may be provided in lieu of a 12 pulse or greater VFD as long as the 6 pulse VFD-filter combination is proven to perform the same or better than the respective 12 pulse or greater VFD. Harmonic calculations shall be provided as required to show equivalency.

AA. Harmonic compliance shall be verified onsite with field measurements of both voltage and current harmonic distortion at the PCC. A recording type fluke 41 or equivalent harmonic analyzer displaying individual and total harmonic currents and voltages must be utilized.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motor starters and controllers as indicated on the Drawings, in strict accordance with the manufacturer's written instructions, and in compliance with recognized industry practices.

B. Install fuses or current limiters when required by the equipment specifications.

C. Tighten connections and terminations in accordance with the manufacturer's published torque tightening values or in accordance with UL Standard 486A and B when manufacturer's values are not indicated.

D. Prior to energizing equipment, check power and control wiring for correct installation. After energizing equipment, check each motor for proper phase rotation, correct where necessary, and demonstrate operation of starter and accessories.

E. Program VFDs as required for each individual load. Programming shall include preset speeds, restart attempts and delays, overload settings, frequency avoidance bands, etc.

F. The installation of filters with VFDs shall include all necessary conduit and wiring between the filter and the VFD. Where VFD bypass switches are provided, filter shall be connected so that it is isolated from the VFD in the bypass mode.

G. Set all MCPs in accordance with manufacturer's instructions. Set all overloads in accordance with motor manufacturer instructions.

H. Motor Controllers shall be installed in accordance with manufacturer's recommendations and in accordance with project seismic requirements. Refer to Division 26 Section "Seismic and Wind Controls for Electrical Systems and Equipment" for additional information.

I. Provide labor, materials, tools and coordination required to support commissioning activities in accordance with Division 26 Section "Commissioning of Electrical Systems."

3.2 SPARE PARTS

A. Provide ten (10) lamps of each type and rating supplied with the specified equipment.

B. Provide one (1) of each type of fuse and current limiter for each ten (10) installed, but not less than three (3) of each type and rating.

END OF SECTION 26 29 13

SECTION 26 32 13

DIESEL GENERATOR SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

A. The Contractor shall furnish and install a factory assembled diesel-engine-driven generator set including fan, radiator, rigid mounting base, vibration isolators, silencer, overcurrent protection, day tank, sub-base fuel tank, controls and all accessories specified herein and as required for a complete and functional system.

B. The diesel-engine-driven generator system shall comply with the requirements of NFPA 110, Type 10, Level 1, Class 72 emergency power supply systems.

C. Manufacturer Seismic Qualification Certification: Submit certification that diesel generator system, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

   a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.
4. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

   a. Mounting recommendations shall be provided by the manufacturer based upon the above criteria to verify the seismic design of the equipment.
   b. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
   c. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the

capability of the equipment, meets or exceeds the specified response spectra.

1.3 SUBMITTALS

A. Submit manufacturer's data sheets, wiring schematics installation dimensional drawings for Owner/Engineer, review, comments, and/or approval.

B. Identify all specified items on submittals to assure compliance and ease of review and/or approval.

C. Prior to final test and acceptance, submit final data sheets, schematics and dimensional drawings in neat brochure form.

D. Submittal Data Required:

1. Complete installation drawings, including plan view and elevation with connection of required utilities clearly indicated.
2. Engine/generator controls.
3. Actual electrical schematic, interconnection, and control diagrams.
4. Exhaust silencer and vibration isolators.
5. Battery, battery rack, and battery charger data and installation details.
6. Engineering performance data sheets describing engine, engine performance, fuel consumption rates at 1/4, 1/2, 3/4 and full load, ventilation and combustion air CFM generator details and performance data.
7. Certificate for Seismic Application in accordance with the following International Building Code (IBC) releases: IBC-2000, 2003, 2006, 2009, 2012.
8. The manufacturer shall submit a copy of the specifications with each sub-paragraph noted with the term, "compliance", "deviation", or "alternate".

a. By noting the term "compliance" it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
b. By noting the term "deviation" it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
c. By noting the term "alternate" it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. Any alternate shall be fully described as to what the manufacturer proposes to provide.

1.4 QUALITY ASSURANCE

A. All components of and the complete installation of the diesel generator system shall comply with all applicable requirements of the National Electrical Code relating to emergency and standby power systems.

B. The diesel generator system shall conform to the applicable requirements of the following standards and authorities:

1. NFPA - 37 "Installation and Use of Stationary Combustion Engines and

Gas Turbines"
2. NFPA 110 "Emergency and Standby Power Systems"
3. ANSI/NEMA Standards MG-1 and MG-2
4. Diesel Engine Manufacturer's Association (DEMA)
5. Electrical Generating Systems Marketing Association (EGSMA)
6. Environmental Protection Agency (EPA)

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Caterpillar (Basis of Design)
2. Onan/Cummins
3. Kohler

2.2 ENGINE

A. Diesel fueled, compression ignition firing (“in-line” for under 600 KW and "vee" for 600 KW and above) type cylinder arrangement, 1800 RPM, water cooled with unit mounted radiator, jacket water heaters, mounting frames, and spring-type vibration isolators.

B. The engine shall be specifically designed to operate using #2 diesel fuel.

C. Engine shall be fully equipped with fuel, lube oil and air intake filters; lube oil coolers; fuel transfer pumps; fuel priming pump; flexible fuel lines; service meter; gear driven water pump; unit mounted instruments including a water temperature gauge, and lube oil pressure gauge; service indicators for air cleaner and fuel filter.

D. Provide and install a skid mounted, sub-base located diesel fuel storage tank of steel construction with a capacity to operate the generator at full load for 72 hours. This fuel tank shall support the full weight of the unit. The tank shall be internally coated with corrosion inhibitor, and externally painted to match overall unit color. The fuel tank shall be equipped with a visual fuel gauge, 2 inch (50 mm) fill connection, full flow breather vent, and tank drain located at the opposite end to the fill connection. All piping connections to the equipment shall be made with flexible connectors. Provide a level switch for low level alarm circuitry.

E. Engine exhaust silencer shall be critical zone type, side inlet, inline outlet, flanged inlet and outlet connections to match engine exhaust outlet flanges, and flexible stainless exhaust connection section between engine and silencer.

F. Governor shall be electronic type, isochronous with manual and automatic speed control. Governor shall be capable of +/- 0.25% steady state frequency regulation. Speed shall be sensed by magnetic pickup off the engine flywheel.

G. Unit-mounted radiator, blower fan, engine-driven water pump, thermostat and radiator duct flange shall be provided. The cooling system shall cool the engine in a 125˚F (52˚C) ambient with up to 0.5 inches (13 mm) of water static pressure on the fan.

H. Shut-off devices and circuitry for high water temperature, low oil pressure, engine overspeed, engine overcrank, and high oil temperature shall be provided.

I. Jacket water heaters rated at 208/240V, 1-phase, with automatic thermostats shall be provided.

J. Provide summary alarm contacts (1 N.O. and 1 N.C. rated 10 amperes, 120 VAC) to operate on any one or combination of the following alarms: low oil pressure, high water temperature, overcrank, engine-generator control switch not in automatic and low DC voltage.

2.3 STARTING SYSTEM

A. Starting system shall be 24 volts DC, with positive engagement starting motor mounted on the engine.

B. The starting system shall include fully automatic and manual start-stop features. The system shall include overcrank lockout and shut down after five (5) ten-second cranking periods.

C. Provide 24 VDC lead-acid battery, heavy-duty diesel engine starting type. Battery shall be rated not less than 220 AH and shall provide 120 seconds of cranking power for the engine at the lowest ambient temperature to be encountered. Provide epoxy-treated steel battery rack, intercell and intertier connectors, lugs and cables.

D. Battery charger shall be mounted, in a NEMA-3R enclosure, with float and equalizing charge rates to match battery manufacturer's requirements to maintain proper charge condition, current limiting with overload protective devices, silicon diode full wave rectification, voltage surge suppressor; DC ammeter and voltmeter (+/- 5 percent), fuse protected 120 volt single phase AC input, minimum 10 amp output. Provide low DC voltage alarm relay with one N.O. and one N.C. alarm contact.

2.4 GENERATOR

A. The generator shall be rated 2,000 KW, 2,500 KVA at 0.8 power factor, 480Y/277 volts, 60 HZ at 1800 RPM.

B. The generator shall be a three-phase, single bearing, 54°F (130°C) rise, synchronous type built to NEMA standards. Class F insulation shall be used on the stator and rotor, and no materials which will support fungus growth shall be used. The generator shall include a resettable protector for exciter/regulator protection against extended low power factor loads, and two-level heat detectors.

C. A generator-mounted, exciter/regulator shall be provided to match the characteristics of the generator and engine. Voltage regulation shall be plus or minus 1/2% from no load to full rated load. Readily accessible voltage drop, voltage level, and voltage gain controls shall be mounted on the regulator. Voltage level adjustment shall be a minimum of plus or minus 10%. The solid-state regulator module shall be shock-mounted and epoxy-encapsulated for protection against vibration and atmospheric deterioration.

D. Generator shall be wye connected with an overspeed capability of 125% and less

than 5% wave form deviation.

E. The generator shall be furnished with a series current boost system or a permanent, magnet exciter to force the field during short-circuit conditions. The generator shall be capable of sustaining a minimum of 250 percent rated current for ten (10) seconds under short-circuit conditions.

F. Provide two (2) unit-mounted, circuit breakers with adjustable long time and instantaneous trip settings and a short-circuit rating compatible with the rating of the generator. One circuit breaker shall be used for main power connection to the building. The other circuit breaker shall be used for future temporary load bank connection for testing purposes. Provide lugs on circuit breakers for cable connections.

2.5 CONTROL PANEL

A. Control panel shall be unit-mounted using vibration isolators. All controls shall be resistant to moisture and vibration.

B. Provide two-wire start-stop control for remote connection to ATS and local manual control. Provide three-position AUTO-OFF-RUN selector switch. In the AUTO position, start stop functions shall be controlled from the transfer switch system. In the OFF position, the unit shall not start under any conditions. In the RUN position, the unit shall start and run regardless of the status of the remote start circuit. All safety shut-off devices and circuits shall be operative in both the AUTO and RUN positions. The OFF position shall be used for reset of shut-off alarms.

C. The control panel shall include the following instrumentation:

1. Digital ammeter, voltmeter and frequency meter.
2. Digital power factor meter.
3. Frequency meter, pointer or digital type, +/- 2 percent, 45-65 Hz scale.
4. Panel illuminating lights.
5. Running time meter, 0-9999 hours.
6. Battery charging meter.
7. Alarm panel to indicate low oil pressure, high water temperature, overcrank, overspeed, low battery voltage, low fuel. Provide audible alarm with silence pushbutton. Alarm panel shall satisfy NFPA 110, Level 2 requirements.
8. Engine start/stop selector switch.
9. Output voltage adjustment.

2.6 REMOTE ANNUNCIATOR PANEL

A. NFPA 110, Level 1 requirements for remote annunciation shall be satisfied by a remote mounted panel. Provide lamp test and alarm silence switches.

2.7 UNIT ENCLOSURE

A. Provide a sound attenuated weather-protective walk-in type enclosure with mounted silencer for outdoor applications. Sound pressure levels measured at 7 meters from the enclosure shall be no more than 72 dB(A).

B. Provide skid mounted UL 2085 sub-base fuel tank.

C. Provide enclosure with vertical discharge up type air discharge.

D. Provide internal factory mounted battery charger.

E. 150 mph wind rated enclosure.

F. Galvanized steel work platform located on both long sides for the generator with ships ladder at each end of each platform with safety swing door with padlock attachment. Work platform shall be designed and provided by the generator manufacturer specifically for this project.

2.8 ADDITIONAL EQUIPMENT

A. Internal lights with integral battery backup and wire cages located within the unit enclosure.

B. Internal convenience receptacle located within the unit enclosure.

C. Remote emergency power off button located within the building.

D. Double wall fuel tank with leak detection and two (2) sets of Form C dry output contacts for Owner use.

E. Fuel tank level gauge that provides a 4 – 20 mA output signal indicating tank level for connection to Owner external monitoring system.

F. Internal 100A main circuit breaker, 208y/120v 3 phase, 4 wire panelboard to supply all generator and ancillary equipment including, but not limited to, lights, receptacle, battery charger and jacket water heater. Provide all interconnections from panelboard to equipment supplied.

G. Provide two (2) sets of Form C dry contacts that will change status when any of the ATS's call for start to be used to automatically load shed temporary load bank resistive load if a building outage occurs during load bank testing.

2.9 SIZE RESTRICTIONS

A. The generator size and clearance requirements shall be no larger than dimensions shown on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Contractor shall be completely responsible for installing the engine-generator in the space shown ensuring that code required working space is available around the equipment.

B. Diesel generator system shall be installed in accordance with manufacturer's recommendations and in accordance with project seismic requirements. Refer to Division 26 Section "Seismic and Wind Controls for Electrical Systems and Equipment' for additional information.

C. Provide labor, materials, tools and coordination required to support commissioning activities in accordance with Division 26 Section "Commissioning of Electrical Systems."

3.2 TESTING AND CERTIFICATION

A. After fabrication in the manufacturer's plant, an operational test shall be conducted to check out the entire system before delivery.

B. After installation, the manufacturer shall provide the services of a competent factory based service engineer to coordinate the installation of the engine generator system. He shall assist in placing the equipment into operation and provide instruction as required to the person or persons who are delegated to operate the equipment.

C. The manufacturer of the generator shall inspect and verify the correct installation of the generating system. All individual components including, but not limited to, the engine, generator, fuel tank, battery, battery charger, and silencer shall be checked. Power conductors and control circuits shall also be checked.

D. The manufacturer of the generator set shall provide the services of a qualified technician for initial start-up. Checks and services shall be conducted to prepare all equipment for start-up. All alarm circuits and safety shutdown circuits shall be checked. The technician shall follow a routine start-up procedure as recommended by the equipment manufacturer.

E. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.

F. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified, including, but not limited to, single-step full-load pickup test. Provide load bank as necessary.

G. Coordinate tests with tests for transfer switches and run them concurrently.

H. Field service must be unlimited and must continue until satisfactory system operation and customer approval has been achieved.

I. Operating and maintenance instructions shall be provided. Instructions shall be provided in accordance with Division-26 Section, Basic Electrical Materials and Methods.

J. The manufacturer shall warrant the equipment specified herein to be free from defects in material or workmanship. In the event any defects are discovered within twelve (12) months from start-up or eighteen (18) months from date of delivery, the manufacturer shall perform repairs or replacement, at its own option, of any defective products at no cost to the Owner.

END OF SECTION 26 32 13

SECTION 26 36 00

AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

A. This specification describes the requirements associated with the automatic transfer switches and associated control devices as indicated on the drawings and as specified herein. The automatic transfer switches shall be manufactured, installed and tested in strict accordance with these specifications.

1.3 SUBMITTALS

A. Submit the following information for Owner/Engineer review, comments and/or approval:

1. Product data.
2. Complete installation drawings, including plan view and elevations with connection of required utilities clearly indicated.
3. Electrical schematics, wiring diagrams, interconnection diagrams and bussing details.
4. Statement of compliance and deviation as specified herein.

B. The manufacturer shall submit a copy of these specifications with each sub-paragraph noted with the comment "compliance", "deviation", or "alternate".

1. By noting the term "compliance", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
2. By noting the term "deviation", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
3. By noting the term "alternate", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. Any alternate shall be fully described as to what the manufacturer proposes to provide.

C. Identify all specified items on submittals to assure compliance and ease of review and/or approval.

D. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.”

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

    a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices and instillation requirements on which the certification is based and their installation requirements.

1.4 QUALITY ASSURANCE

A. The automatic transfer switches shall conform to these specifications and applicable codes and standards published by the following authorities and associations:

1. National Fire Protection Association (NFPA)
2. Underwriter Laboratories (UL), UL 1008
3. NFPA 70, National Electrical Code (NEC)
4. American National Standards Institute (ANSI)
5. National Electrical Manufacturers Association (NEMA)
6. American Society of Testing and Materials (ASTM)
7. Institute of Electrical and Electronics Engineers (IEEE)

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Asco (Basis of Design)
2. Russelectric
3. Zenith

2.2 AUTOMATIC TRANSFER SWITCHES

A. The automatic transfer switch shall be factory assembled with the current ratings, voltages and accessories as indicated on the drawings or specified herein.

B. The switch and all of its associated controls and terminations shall be completely front accessible.

C. The switch shall be mechanically held in both the normal and the emergency positions, and rated for continuous duty in an unventilated enclosure. The switch shall be open transition, break-before-make,double throw with the main contacts rigidly and mechanically interlocked to insure three possible positions: Normal, Emergency or Neutral.

D. The automatic transfer switch shall be of the motor or solenoid type. Circuit breaker type switches are not acceptable and will not be considered.

E. The ATS shall be UL listed, STD UL-1008, with withstand and close-in values which match the overcurrent protective devices for the normal and emergency feeders.

F. The ATS shall be provided in a NEMA type 1 enclosure suitable for the location where the switch will be installed. Enclosure shall be front accessible only allowing switch to be installed directly against a wall located on the back of the switch.

G. All bus shall be copper.

H. The ATS shall be four-pole. The four-pole switches shall have ratings identical to the other poles and shall be mounted on the same shaft. Reduced neutral ratings, overlapping neutral contacts and switches which are not true four-pole switches shall not be acceptable.

I. The ATS shall have a withstand rating equal to the AIC ratings of the circuit breakers from which it is served. The ATS shall be 3 cycle rated.

2.3 ACCESSORIES

A. The ATS shall be provided with the following accessories:

1. Adj. 0.5-3 second time delay on engine start.
2. Adj. 1-300 second time delay on transfer to emergency.
3. Adj. 0-30 minute time delay on transfer to normal.
4. Fixed 5 minute time delay for engine cool-down.
5. Load test switch, maintained type.
6. One (1) contact to open and one (1) contact to close on failure of normal to be used for engine starting.
7. Pilot lights to indicate switch position.
8. Two (2) auxiliary contacts closed in normal.
9. Two (2) auxiliary contacts closed in emergency.
10. Adjustable close differential voltage sensing on all phases of normal, pick-up set at 90%, drop-out set at 85% of nominal.
11. Voltage and frequency sensing of emergency source, voltage pick-up set at 90%, frequency pick-up set at 95% of nominal.
12. An automatic seven (7) day exerciser clock, enabling the engine to be automatically started and run without load for thirty (30) minutes each week at a preprogrammed time period. The transfer switch shall remain in the "normal" position unless a commercial power failure occurs during the exercise period.
13. An additional set of main-shaft auxiliary contacts (1 N.O. and 1 N.C.) and two (2) time delay contacts for connection to the elevator controllers. The time delay contacts shall open twenty (20) seconds (adjustable 1-300 seconds) before transfer in either direction and reclose after transfer is complete.

B. The ATS shall have an open transition time between the opening of the closed contacts and the closing of the open contacts adjustable from 1-300 seconds.

C. The ATS shall be equipped with a safe manual operator. The manual operator

shall provide the same contact-to-contact transfer speed as the electrical operator. The manual operator shall be operable with the ATS door in the closed position.

D. All relays, timers, control wiring shall be front accessible. All adjustable time delays shall have calibrated marks for field adjustments. Time delay relays/circuits which cannot be accurately set in the field without the use of test equipment are not acceptable.

2.4 OPERATION

A. Upon loss of normal power and after an adjustable time delay, the switch shall signal the standby generator to start.

B. The transfer switch shall transfer to emergency when the output of the standby generator reaches 90% of rated voltage and 95% of rated frequency. If the emergency source is not available, or if the generator voltage is less than 90% nominal, transfer to emergency shall be inhibited.

C. After the normal source has been restored to 90% of rated voltage, the transfer switch shall retransfer to the normal source after an adjustable time period of 0 to 30 minutes.

D. The standby generator shall continue to run unloaded for five (5) minutes and then shutdown. All controls shall automatically reset in preparation for the next power failure.

2.5 BYPASS-ISOLATION SWITCHES

A. Provide factory-assembled, manually operated, bypass-isolation switches and all auxiliary equipment required for complete operation at locations shown on the drawings.

B. The bypass-isolation switch shall allow the load to be transferred to either source regardless of the position of the ATS. Positive sequencing of all contacts shall be accomplished using external manual operators.

C. The bypass-isolation switch shall permit complete testing and maintenance of the ATS. When the switch is in the bypass position, the load shall be connected to the normal or emergency source, and the ATS shall be energized for testing. When the switch is in the isolation position, the load shall be connected to either the normal or the emergency source, and the ATS shall be isolated from all sources of supply for maintenance.

D. The bypass-isolation switch shall have the same electrical ratings as the ATS with respect to current rating, voltage, frequency, poles, withstand and close-in. The switch shall be of the load break type.

E. The bypass-isolation switch shall be installed in the same enclosure as the ATS and shall be by the same manufacturer as the ATS.

F. The bypass-isolation switch shall have the necessary controls to ensure that the engine start contacts remain closed when the load is bypassed to the emergency source.

2.6 SIZE RESTRICTION

A. The ATS size and clearance requirements shall be no larger than dimensions shown on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the automatic transfer switches in the space shown.

B. Connect auxiliary and control contacts in ATS to the elevator controllers in accordance with the elevator manufacturer's instructions.

C. Connect auxiliary and control contacts in ATS to the engine-generator control panel in accordance with the engine-generator manufacturer's instructions.

D. Connect auxiliary and control contacts in ATS to the fire alarm annunciators and controls in accordance with the fire alarm instructions.

E. ATS shall be installed in accordance with manufacturer’s recommendations and in accordance with project seismic requirements. Refer to Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment’ for additional information.

F. Provide labor, materials, tools and coordination required to support commissioning activities in accordance with Division 26 Section “Commissioning of Electrical Systems.”

3.2 TESTING AND CERTIFICATION

A. Test and demonstrate to the Owner's representative (with factory representative present) that the transfer switch meets the requirements of this specification.

B. Demonstration shall include, but not be limited to, the operation of all time delays, starting contacts, and transfer functions.

C. All testing shall be scheduled at the convenience of the Owner, and shall be arranged at least two (2) weeks in advance.

D. Services shall include a minimum of two (2) visits by representatives of the ATS manufacturer as follows:

1. Following installation, the manufacturer of the ATS shall inspect and verify the correct installation of the ATS. All individual components shall be checked. Power conductors and control circuits shall also be checked.
2. The manufacturer of the ATS shall provide the services of a qualified technician for initial start-up. Checks and services shall be conducted to prepare equipment for energization.
3. Field service must be unlimited and must continue until satisfactory system operation and customer approval has been achieved.
4. Prior to system turnover, an instruction period for operation shall be provided.

E. Final data sheets, schematics, dimensional drawings, and operating and maintenance instructions shall be provided. This information shall be provided in the operating and maintenance manuals specified in Division-26 Section, Basic Electrical Materials and Methods.

END OF SECTION 26 36 00

SECTION 26 41 13

LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

A. The Contractor shall furnish all labor and materials to furnish and install a UL-listed Master-Labeled lightning protection system for the structure or structures to be constructed under this Contract. The lightning protection system shall incorporate all roof-top equipment.

B. The Contractor shall furnish all labor and materials to furnish and install a UL-listed lightning protection system for all new roof-top equipment located on an existing roof. The Contractor shall extend the existing lightning protection system to incorporate the new equipment.

1.3 SUBMITTALS

A. Submit product data for each component of the lightning protection system.

B. Submit shop drawings indicating air terminal locations, secondary conductor requirements, number and routing of main conductors, locations and details of ground rod installation, and other installation details and instructions.

C. Roof plans shall be at 1/8 inch (3 mm) or 1/4 inch (6 mm) scale, site plans shall be at 1 inch (25 mm) equals 20 feet (6 m).

D. Computer (CADD) files of electrical drawings will not be made available to the Contractor for any purposes.

E. Manufacturer Seismic Qualification Certification: Submit certification that lightning protection, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

   a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices and installation

requirements on which the certification is based and their installation requirements.

1.4 QUALITY ASSURANCE

A. The Contractor shall engage an UL-Listed Installer to install the lightning protection system. The name of the Installer and evidence of current UL-listed status shall be furnished with the submittal data.

B. All lightning protection system components and the installation of the lighting protection system shall comply with the following codes and standards:

1. NFPA 70, National Electrical Code
2. NFPA 780, Lightning Protection Code
3. UL 96, Lightning Protection Components
4. UL 96A, Installation Requirements for Lightning Protection Systems
5. ANSI C2, National Electrical Safety Code
6. LPI-175, Lightning Protection Installation Standard
7. LPI-176, Lightning Protection System Material and Components Standard
8. LPI-177, Inspection Guide for LPI Certified Systems
(LPI - Lightning Protection Institute)

C. A copy of the submittal data shall be sent to, reviewed by, and approved by the Owner's underwriters for the referenced project.

PART 2 - PRODUCTS

2.1 LIGHTNING PROTECTION COMPONENTS

A. Lightning protection system components shall include, but not be limited to:

1. Air terminals
2. Bonding plates
3. Conductors
4. Connectors, splices and clamps
5. Ground rods

B. Lightning protection system components shall comply with UL 96A. All components shall be listed and labeled where available.

C. All conductors shall be stranded copper unless applicable standards require the use of aluminum due to building construction materials.

D. Air terminals shall be solid copper unless applicable standards require the use of aluminum due to building construction materials and shall extend at least 18" (450 mm) above the object to be protected.

E. Ground rods shall be minimum 5/8 inch (16 mm) diameter, 10 feet long (3 m). Ground rods shall be copper clad steel.

F. The use of combinations of materials which accelerate corrosion through electrolytic action is prohibited. Conductors and components shall have protective coatings where installation or unusual service conditions may cause

deterioration.

G. The structural steel columns on the outside perimeter of the building may be utilized as the main down conductor from roof to ground. No other parts of the structural steel structure shall substitute for lightning protection conductors. The steel columns used shall not average over 60 feet (18 m) apart. The top of each column used shall be connected to the roof perimeter conductor. The bottom or lowest accessible point of each column shall be connected to a ground rod. All connections to steel shall be exothermic welds.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the lightning protection system in strict accordance with the manufacturer's written instructions and the approved shop drawings.

B. Splices and connections between conductors and other system components shall be made using exothermic welded connections.

C. Connections shall comply with the requirements of Division-26 Sections, “Electrical Connections” and “Grounding”, except as modified herein.

D. Inspections shall be performed in accordance with LPI-177.

E. Installation shall be UL inspected.

F. All down conductors shall be located concealed within the building interior and shall not be located on the building exterior.

G. Lightning Protection shall be installed in accordance with manufacturer’s recommendations and in accordance with project seismic requirements. Refer to Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment’ for additional information.

3.2 CERTIFICATION

A. The installation inspections shall be documented in accordance with LPI-177. Documentation shall be included in the Operating Instructions and Maintenance Manuals specified in Division-26 Section, “Basic Electrical Materials and Methods”.

B. A UL Master Label shall be furnished to the Owner's representative. A copy of the UL Master Label shall be included in the Operating Instruction and Maintenance Manual specified in Division-26 Section, “Basic Electrical Materials and Methods”.

END OF SECTION 26 41 13

SECTION 26 43 13

TRANSIENT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this section.

1.2 SCOPE

A. The Contractor shall furnish and install the Transient Voltage Surge Suppression (TVSS) equipment having the electrical characteristics, ratings and modifications as specified herein and/or as shown on the contract drawings. To maximize performance and reliability, the AC surge protection is to be integrated into electrical distribution equipment such as switchgear, switchboard, panelboard and/or motor control center, or as shown on the contract drawings.

B. References: The TVSS units and all components shall be designed, manufactured and tested in accordance with the latest applicable UL listed standards (UL 1449, 3rd Edition), UL 1283 and CSA certified per CSA 22.2

1.3 SUBMITTALS

A. The following information shall be submitted to the Engineer:

1. Provide verification that the TVSS device complies with the required UL 1449 3rd Edition and CSA approvals.
2. Provide actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41Category C3 and C1 (combination wave) and B3 (ringwave) tested in accordance with ANSI/IEEE C62.45.
3. For retrofit mounting applications, drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.
4. Provide test report from a recognized independent testing laboratory verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the IEEE C62.41, 8 x 20 microsecond current wave. Note that test data on individual module is not accepted.
5. Joule ratings shall not be acceptable in lieu of UL 1449 3rd Edition test data.
6. Descriptive bulletins.
7. Product sheets.
8. Final record drawings.

1.4 QUALIFICATIONS

A. The manufacturer must have a 24-hour response capability with field engineering personnel. The field service organization must have fully accredited Power

System Engineers located across the USA/Canada who are capable of performing complete grounding, Power Quality analysis, and coordination studies. Factory trained TVSS sales personnel do not qualify as Power System Engineers.

B. The manufacturer of the AC distribution equipment shall be the same manufacturer of surge protection devices described in Parts B, C and D.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Cutler-Hammer: Clipper Power System or approved equivalent.

2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

A. Electrical Requirements:

1. Unit Operating Voltage: Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV): The MCOV shall be greater than 115% of the nominal system operating voltage.
3. Protection Modes: For a wye configured system, the device must have directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For a delta configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).
4. UL 1449 3rd Edition SVR: The maximum UL 1449 3rd Edition SVR for the device must not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	400 V	800 V	1000 V
L-L	700 V	1500 V	1800 V

5. ANSI/IEEE Cat C3 Let Through Voltage: The let through voltage based on IEEE C62.41 and C62.45 recommended procedures for Category C3 surges (20 kV, 10 kA) shall be less than:

Modes	208Y/120	480Y/277	600Y/347
L-N	470 V	900 V	1300 V

6. ANSI/IEEE Cat. B3 Let Through Voltage: Let through voltage based on IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. B3 ringwave (6 kV, 5000 amps) shall be less than:

Modes	208Y/120	480Y/277	600Y/347
L-N	150 V	200 V	300 V

B. TVSS Design:

1. Balanced Suppression Platform: The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV.
2. Electrical Noise Filter: Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 55 dB at 100 kHz using the MIL-STD-220A insertion loss test method. The unit shall be complimentary listed to UL 1283. Products not able to demonstrate noise attenuation of 55 dB @ 100 kHz shall be rejected.
3. Internal Connections: No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.
4. Safety and Diagnostic Monitoring: Each unit shall be equipped with 200 kAIC internal fuses. Each unit shall provide the following three (3) levels of monitoring:

    a. Continuous monitoring of fusing system.
    b. Internal infrared sensor system for monitoring individual MOVs (including neutral to ground). The system must be capable of identifying open circuit failures not monitored by conventional fusing systems.
    c. Thermal detection circuit shall monitor for overheating in all modes due to thermal runaway.
    d. A green/red solid state indicator light shall be provided on each phase. The absence of a green light and the presence of a red light, shall indicate which phase(s) have been damaged. Fault detection will activate a flashing trouble light. Units which cannot detect open-circuit damage, thermal conditions and over current will not be accepted.

5. Remote Status Monitor: The TVSS device must include form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three (3) monitoring systems described detect a fault condition.

2.3 SYSTEM APPLICATION

A. The TVSS applications covered under this section include distribution and branch panel locations, bus plugs, motor control centers (MCC), switchgear, and switchboard assemblies. The branch panel located TVSS shall be tested and demonstrate they are suitable for ANSI/IEEE C62.41 Category C1 environments.

B. Surge Current Capacity: The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as shown in the following table:

Application	Min. Surge Current Per Phase	Min. Surge Current Per Mode*
Service Entrance (Switchboards Switchgear, MCC Main Entrance)	240 kA	125 kA
Distribution Panelboards	160 kA	80 kA
High Exposure Roof Top Locations	160 kA	80 kA
Branch Locations (Panelboards, MCC's, Busway)	120 kA	60 kA

C. Panelboard and Bus Plug Requirements:

1. The TVSS application covered under this section include distribution, branch panel and bus plug locations. The TVSS units shall be tested to demonstrate suitability for ANSI/IEEE C62.41 Category C1 environments.
2. Panelboards rated 240 VAC or less shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical.
3. Panelboards rated 480 VAC shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 14,000 amperes RMS symmetrical.
4. Panelboards shall be labeled with a UL short-circuit withstand rating. When series ratings are applied with integral or remote upstream devices, a label shall be provided. Series ratings shall cover all trip ratings or installed frames. It shall state the conditions of the UL series ratings including:

    a. Size and type of upstream device
    b. Branch devices that can be used
    c. UL series short-circuit rating.

5. Branch panels shall be UL labeled as "suitable for non-linear loads".
6. Distribution and panel suppressors shall be installed inside the panelboards or bus plugs at the manufacturer's factory.
7. A direct bus bar connection shall be used to mount the TVSS component to the panelboard bus bar or the bus plug disconnect to reduce the impedance of the shunt path.
8. The TVSS panelboard shall be constructed using a direct bus bar connection (cable connection between bus bar and TVSS device is not acceptable). TVSS units that use a wire connection do not meet the intent of this specification.
9. Suppression shall be included and mounted within the panelboard and bus plug by the manufacturer of the panelboard or bus way.

D. Retrofit Installation (externally mounted suppressor). Maximum conductor lead length between breaker and suppressor shall not exceed 14 inches (360 mm). Comply with manufacturer's recommended installation and wiring practices.

E. Switchgear, Switchboard and MCC Requirements:

1. The TVSS application covered under this section is for switchboard locations. The service entrance TVSS shall be tested and suitable for ANSI/IEEE C62.41 Category C3 environments.
2. Service entrance suppressor shall be installed by assembly manufacturer.
3. Service entrance suppressors shall be installed in the assembly.
4. Locate suppressor on load side of main disconnect device, as close as possible to the phase conductors and ground/neutral bar.
5. Provide a 30 amp disconnect. The disconnect shall be directly integrated to the suppressor and assembly bus using bolted bus bar connections.
6. The suppressor and integral disconnect shall be installed in the switchboard using a direct bus bar connection (no cable connection between bus bar and TVSS device). TVSS units that use a wire connection do not meet the intent of this specification.
7. All monitoring diagnostics features such as indicator lights, trouble alarms and surge counter (if specified) shall be mounted on the front of the switchboard.

2.4 ACCESSORIES

A. Push to test feature to verify operational integrity.

B. Form C dry contacts one (1) NO, one (1) NC for remote status monitoring.

C. Provide audible alarm and surge counter as shown on the contract drawings.

2.5 ENCLOSURES

A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:

1. NEMA 1 surface or flush-mounted general purpose enclosures primarily intended for indoor use.
2. NEMA 12 dust-tight enclosures intended for indoor use primarily to provide protection against circulating dust, falling dirt and dripping non-corrosive liquids (Panelboards Only).
3. NEMA 3R rainproof enclosures intended for outdoor use primarily to provide protection against rain, sleet and damage from external ice formation.
4. NEMA 4 watertight stainless steel intended for indoor or outdoor use primarily to provide protection against windblown dust and rain, splashing rain, hose-directed water, and damage from external ice formation. (Side Mounted Units Only).

PART 3 - EXECUTION

3.1 EXAMINATION

3.2 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.3 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

END OF SECTION 26 43 13

SECTION 26 51 00

LIGHTING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

A. The extent, location and details of exterior and interior lighting fixtures are indicated on the Drawings, in the schedules and in these Specifications.

B. The Contractor shall furnish and install all lighting fixtures and shall perform all lighting fixture work indicated.

1.3 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each type of lighting fixture specified and each component required for a complete installation.

B. Submit shop drawings with each type of lighting fixture and all accessories clearly identified.

C. Submit wiring diagrams for lighting fixtures and accessories including photo controls, dimmers and controllers.

D. Provide footcandle plot diagrams for exterior areas indicating footcandles on grade resulting from the light sources at the locations indicated on the Drawings. Indicate locations, spacing and height of fixtures.

E. Provide shop drawings indicating the locations of occupancy sensors and the effective coverage of each sensor.

F. Submittal for Product Substitutions: All products submitted which are other than the make and model called out in the Construction Documents are considered “Substitutions”. The Contractor must submit the following for all substitutions:

1. Provide cut sheet/product data for substitute item, including list price.
2. Provide cut sheet/product data for specified item, including list price.
3. Provide point-by-point photometric calculations using the substitute light fixture(s) for the entire project area or portions thereof as directed by the Engineer. The Contractor is responsible for contacting the Engineer to obtain the required calculation parameters. Point spacing, total light loss, work plane height, and other parameters shall be provided upon request in order to match the Engineer’s photometric model. Submittal review will be withheld until photometric calculations for substitutions are received.

4. When requested by the Engineer, provide a light fixture sample of the specified fixture and the substitute fixture for comparison. Samples shall be complete with lamps and cord/plug for 120V operation.
5. It is the Contractor's responsibility to prove that substitutes are "equal".

G. Light fixture submittals shall include the fixture, lamp, ballast and maximum input wattage for each and every fixture in one submittal package. This information shall be clearly indicated in the submittal. The lighting fixture submittal package will not be reviewed until this information is submitted as required. Input wattage shall not exceed the maximum allowable total input watt value shown in the lighting fixture schedule.

H. Light fixtures shall be coordinated with project specific lighting control system devices. Provide a letter/ statement in the lighting fixture submittal that conforms that all lighting fixtures have been coordinated with the specific lighting control system devices that will be used on this project.

I. Manufacturer Seismic Qualification Certification: Submit certification that lighting fixtures, accessories, and components will withstand seismic forces defined in Division 26 Section "Seismic and Wind Controls for Electrical Systems and Equipment." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices and installation methods on which the certification is based and their installation requirements.

4. **NOTE:** the use of non-seismic rated lighting fixtures shall be permitted provided they are supported in accordance with ASCE 7 requirements that allow for this exception. Coordinate this with support methods and provide a statement in the lighting submittal stating that this coordination has been performed.

1.4 QUALITY ASSURANCE

A. Comply with applicable requirements of local codes and NEC Articles 220 and 410 as applicable to construction and installation of lighting fixtures.

B. Comply with applicable NEMA, IES and UL standards. Lighting fixtures and components shall be UL listed and labeled.

C. Fluorescent ballasts shall have a CBM label.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

A. Provide lighting fixtures of the sizes, types and ratings indicated on the Drawings and in the schedules. Fixtures shall be complete with housings, energy efficient ballasts, starters, wiring, energy efficient lamps, lamp holders, lenses, louvers and reflectors.

B. Fixtures shall be factory assembled with all components required for a complete installation.

C. Wiring within fixtures shall comply with Article 402 of the National Electrical Code; and shall not be smaller than 18 AWG. Wiring in fixtures shall be suitable for connection to branch circuit wiring. Factory supplied whips shall include wiring not less than 12 AWG.

D. Fluorescent lamp ballasts shall be in compliance with Division-26 Section, Lamps and Ballasts.

E. High-intensity discharge lamp ballasts shall be in compliance with Division-26 Section, Lamps and Ballasts.

F. Lamps shall be the types, ratings and wattages as indicated on the Drawings and in the schedules, as well as in compliance with Division-26 Section, Lamps and Ballasts.

G. Contractor shall include 10 exit light fixtures, in addition to the fixtures shown on the drawings, inclusive of associated labor and material to install after final walk-thru by Fire Marshal. Devices shall be installed in locations as directed by Fire Marshal, and shall include all cutting, patching and finishing of walls. All unused fixtures shall be turned over to the owner for use as spares.

2.2 PHOTO CONTROL

A. Photo control relays shall be hermetically sealed in a die-cast housing with field adjustable light-level control.

B. Photo control relays shall be rated 1800 watts, 120-277 volt, incandescent. Relay ratings shall be coordinated with fixture ratings when used with HID lamps.

C. Photo control relays shall have positive, snap-action contacts, and shall have a built in 15-60 second time delay to eliminate cycling. The relays shall be suitable for operating temperatures from -50 to +150 degrees F (-58 to 302 degrees F).

2.3 EMERGENCY LIGHTING

A. Provide self-contained fluorescent battery inverter units where indicated on the Drawings and in the schedules. Emergency inverter units shall be internal, factory-mounted except where specifically noted otherwise.

B. Batteries shall be sealed, spillproof, rechargeable, maintenance-free nickel cadmium or pure lead type.

C. A solid state constant-current charger shall recharge batteries within twenty-four (24)

hours of discharge and shall maintain batteries at a fully charged state during normal operation. A low-voltage disconnect shall prevent deep discharge of the batteries.

D. The inverter unit shall operate one lamp for a period of no less than ninety (90) minutes upon a sustained drop in line voltage to 80 percent of nominal or below.

E. A test switch and AC "ON" or unit-ready indicator shall be provided.

F. Contractor shall include [10] emergency light fixtures inclusive of associated labor and material to install after final walk-thru by Fire Marshal. Devices shall be installed in locations as directed by Fire Marshal and shall include all cutting, patching and finishing of walls. All unused fixtures shall be turned over to the Owner for use as spares.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lighting fixtures at locations, and at heights as indicated, in accordance with the manufacturer's written instructions to ensure lighting fixtures fulfill requirements.

B. Fixture installations shall conform to applicable requirements of NEC, NECA "Standard of Installation", NEMA standards and recognized industry practices.

C. Provide supports, brackets, fixtures and/or fixture outlet boxes with hangers to properly support fixture weight.

D. Flush mounted fixtures shall be installed to eliminate light leakage between fixture frame and finished surface.

E. Air closures of air handling type fixtures shall be left closed for adjustment by Mechanical or Air Balancing Contractor.

F. Fixtures shall be secured to structural supports. Pendant fixtures shall be plumb and level. Pendant mounted fixtures, larger than 2 feet (600 mm) shall be installed with two (2) stem hangers. Stem hangers shall have ball aligners and provisions for minimum one inch vertical adjustment.

G. Surface mounted fixtures greater than 2 feet (600 mm) in length shall be supported from at least one point in addition to the fixture outlet box stud.

H. Connections and terminations shall be tightened in accordance with equipment manufacturer's published torque tightening values or in accordance with values specified by UL when manufacturer's values are not indicated.

I. Replace defective and burned out lamps for a period of one (1) year following the Date of Substantial Completion.

J. Set, aim and adjust adjustable fixtures in accordance with instructions and guidelines provided by the Architect. Adjust light level of photo control relays in accordance with instructions from Architect.

K. Clean fixtures upon completion of construction.

L. Plaster frames shall be provided for all recessed fixtures, installed in other than a suspended access ceiling system.

M. Lighting fixtures shall be installed in accordance with manufacturer's recommendations and in accordance with project seismic requirements.

3.2 SPARE LAMPS

A. Furnish spare lamps amounting to 15 percent of installed capacity, but not less than four (4) lamps, of each type and rating used on the project. Deliver spare lamps to the Owner's place of storage.

END OF SECTION 26 51 00

SECTION 26 52 00

LAMPS AND BALLASTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Applicable sections of the General Conditions and Supplementary Conditions shall govern the work of this contract as specified here and in all sections of Division-26. All requirements shall be completely fulfilled to the entire satisfaction of the Architect and of the Owner.

1.2 REFERENCE CODES AND STANDARDS

A. Electrical Testing Laboratories (ETL).

B. Underwriters Laboratories, Inc. (UL) labeling and/or listing.

C. National Electrical Code (NEC) - latest edition.

D. Certified Ballast Manufacturers (CBM).

1.3 SUBMITTALS

A. Submit six (6) sets of shop drawings to the Design Professional for review. The submittal shall be in spread sheet format indicating each specified fixture by type designation, with corresponding lamp manufacturer's name and catalogue number, lamp type, wattage, voltage, and ballast type, if applicable.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURER

A. The following manufacturers are approved for use.

1. Incandescent Lamps:

a. General Electric
b. Osram/Sylvania
c. Philips

2. Fluorescent Lamps:

a. Osram/Sylvania - "Octron"
b. Philips - "Octolume"
c. General Electric - "Trimline"

3. Fluorescent Lamp Ballasts:

   a. Advance - "Mark V"
   b. Universal - Triad "Ballastar"

4. Fluorescent Dimming Ballasts:

   a. Lutron - “Hi-lume FDB”

5. Compact Fluorescent Lamps:

   a. Philips
   b. Osram/Sylvania
   c. General Electric

6. Compact Fluorescent Lamp Ballasts:

   a. Radionic Industries, Inc.
   b. Universal
   c. Advance
   d. Robertson

7. Metal Halide Lamps:

   a. Venture Lighting
   b. Osram/Sylvania
   c. Philips
   d. General Electric

8. Metal Halide Ballasts:

   a. Universal
   b. Advance

2.2 LAMPS

A. Fluorescent Lamps:

1. T8 fluorescent lamps shall be 265 MA, rapid start, with a correlated color temperature of 3500K and a color rendering index (CRI) of 86, unless otherwise noted in the Contract Documents.
2. T5 fluorescent lamps shall be of the types and sizes specified in the Lighting Fixture Schedule with a correlated color temperature of 3500K and a color rendering index (CRI) of 85.

B. Compact Fluorescent Lamps:

1. Compact fluorescent lamps shall be twin and triple tube configurations, with a correlated color temperature of 3500K and a color rendering index (CRI) of 82, in types and sizes specified in the lighting fixture schedule.

C. Incandescent Lamps:

1. Incandescent lamps shall be of types and sizes specified in the lighting fixture schedule and shall be rated 130 VAC.

2. Type BR, ER, and R20 incandescent reflector lamps must meet the same efficacy standards as Energy Policy Act (EPACT) 1991.

D. Metal Halide Lamps:

1. Metal halide lamps shall be clear, of the size and shape indicated on the lighting fixture schedule, with a correlated color temperature of 3200K and a color rendering index (CRI) of 65, unless otherwise noted in the Contract Documents.

2.3 BALLASTS

A. General: Ballasts for fluorescent fixtures shall be suitable for the electrical characteristics of the supply circuits to which they are to be connected, and shall be suitable for operating the specified lamps. All ballasts used for double-ended lamps shall be provided with a ballast disconnecting means per NEC 2011, Article 410.130(G). This disconnecting means shall be installed on each ballast at the factory or by the contractor in the field.

B. Fluorescent Ballasts:

1. Unless otherwise indicated in the lighting fixture schedule, ballasts shall be the low energy, full output solid-state type for use on 2 foot (600 mm), 3 foot (900 mm) and 4 foot (1200 mm), 265MA, rapid start T8 lamps.
2. All ballasts shall be UL listed, Class "P", Type 1 Outdoor, high power factor with a minimum ballast factor of 88%.
3. Single, two-lamp or three-lamp fluorescent ballasts shall be used in any one luminaire.
4. Ballasts shall have a Class "A" sound rating or better.
5. Total harmonic distortion shall not exceed 10%.
6. Ballasts shall have an average lamp current crest factor of 1.7.
7. Ballasts shall comply with FCC Title 47, Part 18, Subpart C, Class A, Non-Consumer Equipment for EMI and RFI.
8. Ballasts shall have a frequency of 20KHz or greater and shall operate without visible flicker.
9. Maximum ballast case operating temperature shall not exceed 167°F (75°C).
10. For applications with 12 hour on, 12 hour off cycle, ballasts shall be instant start. Ballasts used with occupancy sensors shall be programmed rapid start.
11. Ballasts for T5 lamps shall incorporate auto reset shutdown circuitry for end of life protection.
12. Ballasts shall provide transient immunity recommended by ANSI C62.41-1991 location category A2.
13. Ballasts shall tolerate open and short circuit output conditions without damage.
14. Ballasts shall be CSA certified where applicable.

C. Fluorescent Dimming Ballasts:

1. All lamps on the same circuit must have the same current rating (i.e., T8), but may be different lengths (i.e., 3', 4'). Manufacturer shall provide single, two or three lamp electronic dimming ballasts as required.
2. Ballasts shall withstand 4000 volt surges as specified in ANSI C62.41.

3. Ballasts shall preheat lamp cathodes before applying arc voltage to ensure rated lamp life is not diminished.
4. Ballasts shall internally limit inrush current to not exceed three amps at 277 volts or seven amps at 120 volts to avoid computer problems, nuisance breaker trips and control contact malfunctions.
5. Light level output shall be continuous, even and flicker-free over the entire dimming range.
6. Ballast shall be inaudible in a 27dB ambient throughout the dimming range.
7. Ballast shall be capable of striking lamps at any light level. This shall be accomplished without first flashing to full light.
8. Ballasts must comply with FCC Part 18 regulations for non-consumer RF lighting devices.
9. Ballasts shall have a minimum starting temperature of 10˚C.
10. Ballasts shall not be damaged by mis-wiring line voltage and control wire inputs.
11. Architectural dimming ballasts:

    a. Architectural dimming ballasts - Lutron Hi-lume FDB series or approved equivalent.
    b. Dimming range of ballasts shall be from 100% to 1% light level for T8 lamps, and 100% to 5% light level for T5 lamps.
    c. Ballast shall have:

        1) Power factor equal to .95.
        2) Ballast factor equal to .93.
        3) Throughout the entire dimming range, magnitude of harmonic distortion current less than 10% of the total input current at full light output.
        4) Lamp current crest factor less than or equal to 1.6.

12. Ballasts will withstand changes in line voltage and frequency with virtually no change in light output.

D. Compact Fluorescent Ballasts:

1. Unless otherwise indicated in the Lighting Fixture Schedule, all ballasts for compact fluorescent lamps shall be high-power-factor, electronic type with auto reset end of lamp life circuit.

E. Metal Halide Ballasts:

1. Unless otherwise indicated in the Lighting Fixture Schedule, all ballasts for metal halide lamps shall be core and coil, constant wattage autotransformer type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all lamps and test for correct operation.

B. Luminaire ballasts not installed as part of a lighting fixture assembly shall be installed above accessible ceilings in metal enclosures as provided by the lighting fixture manufacturer. Secondary wiring to the luminaire shall be in code-approved raceways along the full length of the wiring from ballast enclosure to luminaire.

C. All fluorescent lighting fixtures indicated on the drawings as being connected to a dimmable circuit shall be provided with a fluorescent dimming ballast.

END OF SECTION 26 52 00

SECTION 26 57 20

TELEPHONE AND DATA SYSTEMS SUPPORT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and Division-26 Section, “Basic Electrical Materials and Methods”, apply to this Section.

1.2 SUMMARY

A. The Contractor shall furnish and install, as indicated on the Drawings or specified herein, the following telephone, voice/data and video system equipment and ancillary components:

1. Telephone and data terminal boards
2. Raceways
3. Outlet boxes, pull boxes and junction boxes

B. The telephone utility and other Owner-appointed contractors shall furnish and install the following systems and components:

1. Service entrance cable and connection to the Basic Operating Company system
2. Telephone wiring and cabling
3. Voice and data wiring and cabling
4. Control and signal media
5. Consoles as required
6. Telephone switch and instruments
7. Modems, drivers, terminals and other related equipment
8. Devices
9. Cover plates

1.3 SUBMITTALS

A. Submit product data for all telephone and data equipment being provided.

1.4 QUALITY ASSURANCE

A. All telephone and data system equipment and components shall comply with and be installed in accordance with the latest revision of the following codes and standards:

1. NFPA 70 "National Electrical Code"
2. Applicable sections of FCC Part 68 and Part 15
3. IEEE Standard 241, Section 13
4. Applicable standards by RFA and EIA
5. BICSI "Telecommunications Distribution Methods Manual."

B. All telephone system equipment and components shall be installed in accordance with the requirements of the local Basic Operating Company or utility.

PART 2 - PRODUCTS

2.1 TELEPHONE AND DATA SYSTEM

A. Telephone and data terminal boards shall be constructed of 3/4" (19 mm), 4' x 8' (1200 mm x 2400 mm) fire-rated plywood. Terminal boards shall have smooth surfaces and edges and shall be painted with fire-resistant paint. Terminal boards shall be 8' (2400 mm) high and shall have a length as indicated on the Drawings. Terminal boards shall be installed with the bottom edge 6" (150 mm) AFF.

B. Outlet boxes shall be 4 inch square (100 mm), 2-1/8 inches (53 mm) deep with 1/2 inch (13 mm) raised single-gang covers and blank stainless steel cover plates.

C. Devices shall be provided where indicated on the Drawings by the Basic Operating Company or the Owner-appointed telephone contractor.

D. Telephone raceways shall be as indicated on the Drawings and shall comply with the requirements of Division-26 Section, “Raceways”. Except as noted otherwise, telephone raceways shall be no smaller than 1 inch (25 mm).

2.2 VOICE/DATA AND VIDEO SYSTEM

A. Computer data outlet boxes shall be 4 inch square (100 mm), 2-1/8 inches (53 mm) deep with 1/2 inch (13 mm) raised single gang covers.

B. Data raceways shall be as indicated on the Drawings and shall comply with the requirements of Division-26 Section, “Raceways”. Data raceways shall be no smaller than 1 inch (25 mm).

C. Data raceways in exposed locations shall be rigid steel, raceways in concealed spaces may be EMT.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install telephone and data system equipment and components, where indicated on the Drawings or specified herein, in accordance with manufacturers' written instructions and recognized industry practices.

B. Install a 1 inch (25 mm) empty conduit between each telephone and computer data outlet box and the above-ceiling space or to a height of 9' - 0" (2700 mm - 0 mm) above the finished floor where a removable ceiling is not provided. Provide a 90 degree elbow and bushing on the end of the conduit in the ceiling space. The direction of the elbow shall be adjustable. All empty conduits shall be terminated above accessible ceilings, or extended to backboard when ceilings are not accessible.

C. Install a pull box or junction box after every two (2) 90 degree elbows.

D. Conduit fittings shall not be used. All raceway bends shall be wide-sweep field bends.

E. Conduit terminations at telephone terminal boards shall be extended to 3 inches (75 mm) of the edge of the terminal board and shall be terminated with an insulated bushing.

F. Install a pull wire in each and every empty conduit.

END OF SECTION 26 57 20

DIVISION 27 – COMMUNICATIONS

SECTION 270100

COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Communications equipment coordination and installation.
2. Sleeves for pathways and cables.
3. Sleeve seals.
4. Grout.
5. Common communications installation requirements.
6. Poke Through Devices

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of communications equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting pathways, cables, wireways, and cable trays, will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Section "Penetration Firestopping."."

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, product by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.4 POKE THRU DEVICE

A. Provide large capacity poke-thru device Legrand Wiremold Evolution series model 8ATCPNK-8DP-8B-8ACT6A.

B. Provide suitable manufacturer device mounting plates to serve jacks and outlets indicated.

C. Provide blank off plates, Wiremold # 8B.

D. Provide 8" core drill for each poke-thru device.. Provide x-ray scanning of elevated floor slab for each proposed core drill location to verify core drill area is free from obstructions.

E. Provide Nickel finish cover assembly. Verify cover assembly is compatible with the flooring for each installation

F. Provide a 2 gang 2" conduit bottom housing assembly, Wiremold # 22CHA.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Section "Penetration Firestopping."

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 SCANNING OF EXISTING SLABS

A. The Contractor shall be responsible for selecting and making all penetrations. The Contractor shall provide a scan of each proposed penetration as needed to determine the suitability of proposed penetration.

B. Contractor shall provide X-ray scanning of all elevated slab areas prior to cutting of slab.

C. Contractor shall provide high impulse radar scanning of all slab on grade areas prior to cutting of slab.

D. Contractor shall utilize a professional and qualified concrete cutting and scanning service to perform all work.

E. Scanning shall be provided at each floor cut.

F. Scanning services shall be performed by:

Maryland Q. C. Laboratories, Inc.
11593 Edmonton Road

Beltsville, Maryland 20705
Tel: 301-931-0590
Fax: 301-931-0632

or approved equal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Section "Penetration Firestopping."

END OF SECTION 27 01 00

SECTION 270200

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment floor racks and wall racks
4. Telecommunications pathways and cable trays.
5. Grounding and Bonding.

B. Related Sections:

1. Section "Data, Voice, and Video Systems" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel not exceeding 6 inches (152 mm) in width.

D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of a bottom without ventilation openings within integral or separate longitudinal side rails.

H. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as Commercial Installer, Level 2 to perform the on-site inspection.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

D. Grounding: Comply with ANSI-J-STD-607-A.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.7 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.

1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
2. Support brackets with cable tie slots for fastening cable ties to brackets.
3. Lacing bars, spools, J-hooks, and D-rings.
4. Straps and other devices.

C. Cable Trays:

1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cable Management Solutions, Inc.
   b. Cablofil Inc.
   c. Cooper B-Line, Inc.
   d. Cope - Tyco/Allied Tube & Conduit.
   e. GS Metals Corp.

2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick.

   a. Basket Cable Trays: 12 inches (300 mm) wide and 4 inches (100 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
   b. Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
   c. Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.

D. Conduit and Boxes: Comply with requirements in Division 16.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Section "Rough Carpentry."

B. Provide 4' w x 8' h x 3/4" fire-retardant-treated plywood backboard, painted white, two feet off the floor to top. Secure backboard with a minimum of eight (8) screws. Plywood backboard shall conform to Product Standard PS1, Grade B-D, with exterior glue and one side finished.

2.3 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Chatsworth Products, Inc (CPI).
2. See Section "Data, Voice and Video Systems" for additional requirements

B. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310 standard, 19-inch (480-mm) panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.
4. See Section "Data, Voice and Video Systems" for additional requirements

C. Floor-Mounted 4 Post Racks: 84” high by 30” deep. 4 post floor frame rack shall be CPI # 50120-X03 or approved equal.
1. Double Sided Vertical Cable Management (CPI # 13912-703)
2. Horizontal Cable Management (CPI # 30130-719)
3. Cage Nuts (CPI # 12637-001)
4. Grounding & Bonding lug & kit.
5. Power strip.
6. See Section "Data, Voice and Video Systems" for additional requirements

D. Floor-Mounted 2 Post Racks: 84” high by 30” deep. 2 post floor frame rack shall be CPI # 55053-703 or approved equal.
7. Double Sided Vertical Cable Management (CPI # 30162-703)
8. Horizontal Cable Management (CPI # 30130-719)
9. Cage Nuts (CPI # 12637-001)
10. Grounding & Bonding lug & kit.
11. Power strip.
12. See Section "Data, Voice and Video Systems" for additional requirements

F. Wall Swing Racks: 49” high (27 RMU) by 25” deep. Wall Swing rack shall be CPI # 11807-725 or approved equal.
   13. Double Sided Vertical Cable Management (CPI # 13912-703)
   14. Horizontal Cable Management (CPI # 30130-719)
   15. Cage Nuts (CPI # 12637-001)
   16. Grounding & Bonding lug & kit.
   17. Power strip.
   18. Rack Shelf
   19. See Section "Data, Voice and Video Systems" for additional requirements

G. Cable Management for Equipment Frames:

   20. Metal, with integral wire retaining fingers.
   21. Baked-polyester powder coat finish.
   22. Vertical cable management panels shall have front and rear channels, with covers. CPI # 30162-703.
   23. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each. Panduit 1U-NCMHF1.

2.4 POWER STRIPS

A. Power Strips: Comply with UL 1363.

   1. Rack mounting.
   2. Six 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
   3. LED indicator lights for power and protection status.
   4. LED indicator lights for reverse polarity and open outlet ground.
   5. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
   6. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
   7. Cord connected with 15-foot (4.5-m) line cord.
   8. Rocker-type on-off switch, illuminated when in on position.
   9. Peak Single-Impulse Surge Current Rating: 26 kA per phase.
   10. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.
   11. Power Strips shall be Horizontal type for wall racks CPI # 12816-712 , and Vertical power strip for floor racks CPI # 12851-723, or approved equal.

2.5 GROUNDING

A. Comply with requirements in Division 16 Section for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

   1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
   2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
   3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with ANSI-J-STD-607-A.

2.6 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 TELECOMMUNICATIONS ROOMS

A. Coordinate with Owner's IT and Telephone staff for telecommunications room layout and connections.

B. Install pathways complying with recommendations in TIA/EIA-569-A.

C. Comply with NECA 1.

D. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

E. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

F. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 FIRESTOPPING

A. Comply with requirements in Section "Penetration Firestopping."Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.3 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.3 CABLE ROUTING

A. Wiring for the voice/data/video system shall be installed in cable tray and supported by J hooks, installed four (4') apart. Exposed wiring run in the gymnasium, mechanical rooms, and other rooms where there is no drop ceiling shall be installed in EMT conduit above 10'-0" AFF and in surface metal raceway below 10-0" AFF. EMT conduit in mechanical rooms may be installed in EMT conduit below 10'-0" AFF.

B. All voice and data horizontal cables shall not exceed 90 m (295 ft) from the telecommunications outlet in the work area to the horizontal cross connect. The combined length of jumpers, or patch cords and equipment cables in the telecommunications closet and the work area should not exceed 10m (33 feet) total, including 3 m (10 feet) at the station and 6 m (20 feet) at the closet. Every effort will be made to route cables so as not to exceed 90 meters in length. Contractor will identify any cable runs exceeding 90 meters from proposed MDF/IDF location and shall provide solution to meet the 90-meter requirement.

C. Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation. Cable bends shall be no less than four (4) times the cable outer diameter or 1.00".

D. In open ceiling cabling, cable supports shall be provided by means that are structurally independent of the suspended ceiling, its framework, or supports. These supports shall be spaced no more than 1.2 m (4 feet) apart.

E. Telecommunications pathways, spaces and metallic cables which run parallel with electric power cables or lighting cables shall be installed with a minimum clearance of 300 mm (12 inches). Communication cables shall not be run parallel with electric power cables for more than 10 m (33 feet) if their separation is less than 300 m (12 inches).

F. Cables routed in a suspended ceiling shall not be draped across the ceiling tiles. Cable supports shall be mounted a minimum of 75 mm (3 in) above the ceiling grid supporting the tiles.

G. Cables run exposed above accessible ceilings shall be run in bundles of a size for installation. Bundle by use of cable ties, taking care not to cinch cables. Cable shall be supported from roof structures, joists and other appropriate structural members by means of J hooks. J hooks shall not exceed spacing of four (4) feet. In no case shall any cable be supported from below by contact with the ceiling system. The data, telecommunication and video cabling systems shall be separated into bundles and separated by a minimum of 12". Provide cable ties to secure cables to each "J" hook. Avoid cinching cables.

1. All voice and data telecommunications cable installed above suspended ceilings shall be supported by 2" "J" hooks spaced at a maximum of 48". For support of high density (>50 cables) bulk cable where 48" spacing results in the bowing of cable, the Contractor shall divide bulk cable into smaller parallel streams or decrease the spacing of the "J" hooks sufficiently to adequately support the cable.

2. Where voice and data telecommunication wiring is supported by "J" hooks, wire shall be run neatly bundled with tie wraps. Tie wraps shall be spaced randomly between 6" and 10" apart, 8" on the average. Tie wraps shall be snug, but capable of being easily rotated about the cable bundle so as to secure the cable without binding, deforming or damaging it. Cable deflection shall be less than 5" between "J" hooks.

3. Fiber optic and Category 6 UTP backbone cable shall be run separately from the horizontal distribution cable. This shall be accomplished by running said cable parallel to hori-

zontal distribution cabling supported on the back-side of the “J” hooks used for the horizontal cabling or by supporting the backbone cable separately from the horizontal. In either case, the backbone cabling shall not be tie wrapped together with the horizontal distribution cable.

4. “J” hooks shall be supported directly by the building structure. “J” hooks shall be supported on minimum 3/8" threaded rod anchored to the side hallway walk, or to the slab above. “J” hooks shall ***not*** be attached to or supported by ceiling supports, piping or piping supports, or duct work or duct work supports.

5. Install cabling below or to the side of the duct work, just above the suspended ceiling. Extend “J” hooks down to support the cabling at that level.

3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section "Identification for Electrical Systems."Comply with requirements in Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

B. See Section "Data, Voice and Video Systems" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 3 level of administration including optional identification requirements of this standard.

C. Labels shall be preprinted or computer-printed type.

END OF SECTION 27 02 00

SECTION 27 50 00

DATA, VOICE AND VIDEO SYSTEMS

PART 1 – GENERAL

1.1 SCOPE

A. Provide a complete system of wired data, voice and video outlets suitable for distribution and utilization of signals from the Baltimore County supplied telephone systems, computer data networks and Cable television.

B. The data network wiring shall be suitable for a minimum 1000 Mega-Bits per second (Mb/s) data network.

C. The Data and Voice Structured Cabling and Outlet System shall include, but is not necessarily limited to:

- Category 6 Unshielded Twisted Pair (UTP) Cable
- Armored and Unarmored Fiber Optic Cable – Both Single Mode and Multi-Mode
- RJ-45 modular jacks with integral IDC type connectors
- Wall mounted or stand-alone data cabinets
- Type 110 wiring punch blocks for voice cables
- 48 Port Category 6 Modular Patch Panels
- RG-6 Quad Shielded Video Cable
- Video taps, coaxial cables and signal distribution equipment

D. Any questions regarding the Structured Cabling System, or the equipment to be used shall be resolved prior to bid.

E. Contractor shall visit the site, verify all existing items specified, and be familiar with the working conditions, hazards, phasing and local requirements involved. Contractor shall take these existing conditions into consideration and the lack of specific information in these specifications shall not relieve the Contractor of any responsibility. Provide temporary cabling, supports, terminations, outlets, and all product required to keep existing system operational until new system is complete. Provide temporary cabling and provisions to maintain the system for each phase of construction. Contractor shall provide all field investigations to determine all conditions and circumstances and gather all data and information required for work. Contractor shall survey all equipment and cable routes and wiring devices. Contractor shall provide complete field investigations and coordination to determine and provide all temporary cabling and provisions to maintain systems operation. The contractor shall assume that all information shall be obtained from contractor field surveys and not from contract documents. Contractor shall remove temporary provisions when the need for its services has ended, when it has been replaced by the contractor provided permanent facility.

F. Contractor shall protect and maintain existing voice/data/video systems in school. Contractor shall trace, locate and identify all existing voice/data/video cabling. Provide relocation of existing and new supports for existing cabling. Provide temporary voice/data/video cabling to maintain operation of existing systems.

G. Existing communication and data cabling in building is the result of various installations over the years. Cable type and installation technique varies. All affected existing telephone and network cabling and associated components shall be removed and disposed of unless otherwise directed by Owner. Existing cable routing varies , including in-floor cabling and above ceiling cabling.

H. Contractor shall provide new cabling supports and shall NOT assume that any existing cabling supports exist or can be re-used.

I. Contractor shall provide new surface mounted raceways to conceal all cabling. Existing cabling maybe reused if suitable, but for bid purposes assume all new surface mounted raceways is required for all work.

1.3 STANDARDS

A. Voice and data outlets, wiring and associated work shall be in strict accordance with the requirements of the Baltimore County Office of Information Technology.

B. Cable television outlets, wiring and associated work shall be in strict accordance with the requirements of Comcast or Verizon Communication services.

1.4 COLOR CODING

A. All cabling, jacks, inserts and other system components shall be color coded to identify data versus voice (telephone) facilities. Color codes shall be as specified below, in accordance with the standards set by the Baltimore County Office of Information Technology.

1.	Data Wiring and Jacks:	Green
2.	Voice (Telephone) wiring and jacks:	Green
3.	Fiber optics – multi mode:	Orange (OM1 &2) , Aqua (OM3)
4.	Fiber optics – single mode:	Yellow
5.	Cable TV & IP video monitors:	Black
6.	Emergency/alarm wiring:	Red
7.	Radio communication:	Blue

1.5 SYSTEM DESCRIPTION

A. System includes provision of combination data and/or voice single or multi-jack outlets at locations and in configurations indicated on the drawings, with station cables from each jack to the appropriate termination as specified herein.

B. Typical workstation outlet configurations shall be as indicated on the drawings. Where both voice and data jacks to be provided in the same outlet, the voice jack shall be located at the upper left position.

C. Wall mounted telephone outlets shall be provided with a single, flush mounted RJ-45 modular wiring jack mounted in a stainless steel wall plate with wall telephone instrument mounting lugs.

D. Outlets designated on the plans for pay phones shall consist of a single gang cover plate with single 3/8" diameter bushed hole. Coil 24" of station cable slack within outlet box for direct connection to pay telephone instrument by the telephone equipment provider.

1.6 SUBMITTALS

A. General: Submit the following according to “Basic Electrical Requirements”. Submit product data on each product specified in this section, including, but not limited to the cabinets and cabinet components, cabling, and cabling components, rack hardware and accessories, patch cord organizers and cable ring wiring path blocks, fiber optic cable, multipair telephone cable, Category 6 UTP cable, cable end connectors, wireways, cable management, surge protectors, conduit, and other raceways and associated components, jacks, etc., in a bound, jacketed loose-leaf binder. Each item proposed should be tagged with a star, an arrow, etc.

B. Product Data and Shop Drawings: Submit these items, and the Certifications specified below, as a complete package. Incomplete submittals will not be reviewed.

1. A complete schedule of equipment and materials that are to be furnished for the work. Accompanying the schedule shall be manufacturer's specifications or cut sheets for each major component.. Original specification sheets or clear copies of same shall be submitted on all items. Manufacturers name, make and model number shall appear on each sheet. Submittals shall be bound in booklet form with cover sheet and index, and presented in a neat and logical order in a binder.

2. Complete drawings of equipment racks and special assemblies. Each drawing shall show all equipment with its manufacturer and model number.

3. Complete drawings detailing installation locations of equipment, cable quantities and types with terminal block or patch panel locations.

4. Certification reports for all data wiring run shall be submitted in pursuance with the rules outlined in the “Cable Testing and Acceptance” section of this document.

5. Submit Shop Drawings of each proposed system (Voice/Data/Video) indicating the proposed system configuration and all specified requirements. Shop Drawing shall indicate proposed cable routing, detail installation locations of equipment, cable quantities, cable types, and terminal block locations. All Shop Drawings shall be Contractor’s original drawings. Submission of Engineer’s Contract Drawings as Shop Drawings is not permitted. A detailed set of floor plans for the complete building shall be furnished showing the locations of all equipment and devices and their required interconnections. The interconnections shown shall indicate the number, size, and type of wires as described in this Specification.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. The installing contractor shall submit proof of having installed at least six (6) similar Data And Voice Structured Cabling And Outlet Systems. These systems shall have been in service for a minimum of three (3) years. These systems must have been within a fifty (50) mile radius of the project location. Included with this proof shall be the customer name, customer contact and telephone number, and, if applicable, the architect and electrical engineer on the project. The Architect and Owner retain the right to reject any installing contractor who, in their sole judgment, has not met the above criteria or has received a less than favorable reference from any of the submitted references OR from any other customer for which the installing contractor has performed similar installations, whether or not such customer has been listed on the submittal.

2. In order to assure full compliance with all codes and regulations, the installing contractor must have on its regular staff a Master Electrician licensed within the jurisdiction in which the installation occurs. Proof of such licensing must be included with the original submittal.

3. The Contractor shall make application for all necessary permits, licenses and inspections as required by the Authority Having Jurisdiction, and shall pay all fees and charges appurtenant thereto.

4. The installing contractor must hold a current certification from manufacturer of the Cabling System being proposed for installation. Proof of such certification must be included with the original submittal.

5. Work will be supervised by a registered communications distribution designer (RCDD) during all phases of the installation.

B. Manufacturer Qualifications: Materials proposed for use on this project shall be provided by a manufacturer experienced in manufacturing components listed and labeled under EIA/TIA-568A and who comply with these Specifications.

C. Comply with NFPA 70, "National Electrical Code.", latest edition

D. Comply with the latest editions of following industry standards:

1. ANSI/EIA/TIA 568-B Commercial Building Telecommunications Cable Standard
2. TIA 568-B.1-2000 Commercial Building Telecommunications Wiring Standard
3. EIA/TIA 569A Commercial Building Standard for Telecommunications Pathways and Spaces
4. EIA/TIA 606 Administrative Standard for the Telecommunications Infrastructure of Commercial Buildings
5. EIA/TIA 607 Commercial Building Grounding and Bonding Requirements for Telecommunications

1.8 WARRANTY

A. Special Warranty Requirements:

1. All installation materials furnished and installed by the Contractor shall be fully guaranteed against defects in materials and workmanship for a minimum period of two (2) years after final acceptance by Baltimore County Office of Information Technology. A standard manufacturer’s warranty, on parts and labor or two (2) year warranty on parts

and labor, whichever is greater shall be included as part of these conditions. Defective items must be replaced free of charge during the warranty period.

2. In the event that the certified system ceases to support the certified application(s), whether at the time of cut-over, during normal use or when upgrading, the manufacturer and vendor shall commit to promptly implement corrective action.

1.9 SITE SURVEY

A. Provide examination of site as required by specifications.

B. Prior to placing any cable pathways or cable, the Contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables, and to arrange the removal of any obstructions with the Project Manager accordingly.

C. The Drawings provided are diagrammatic and generally representative of the existing conditions, but not necessarily accurate in all aspects; therefore, verification of these drawings is solely the responsibility of the Contractor. The Contractor shall verify all field conditions and make field measurements as required.

D. Visit the site before submitting bid and check location of utilities, check conditions, verify dimensions and locations shown on the plans, and verify over-all costs and work herein described or shown.

E. Take measurements necessary for this work and be responsible for their accuracy. Necessary pullboxes and junction boxes as required to accomplish distribution shall be provided

PART 2 – PRODUCTS

2.1 TWISTED PAIR CABLES, CONNECTORS, AND TERMINAL EQUIPMENT

A. Station cables for data jacks shall be four (4) pair Category 6 unshielded twisted pair (UTP), plenum-rated solid conductor cable conforming to the ANSI/TIA/EIA-568-B.2 Category 6 component specifications standards. Cable frequency capability shall be 250 MHz or greater and shall exceed IEEE 802.3ab and IEEE 802.3af. Provide Commscope Media 6 (6504 – color per County coding).

B. Station cables for voice jacks shall be four (4) pair Category 6 unshielded twisted pair (UTP), plenum-rated solid conductor cable conforming to the ANSI/TIA/EIA-568-B.2 Category 6 component specifications standards. Cable frequency capability shall be 250 MHz or greater and shall exceed IEEE 802.3ab and IEEE 802.3af. Provide Commscope Media 6 (6504 – color per County coding).

C. UTP Cable Connecting Hardware: Comply with EIA/TIA-568A, TSB 40. Insulation displacement connector (IDC) type, using modules designed for use with punch-down tools.

1. IDC Terminal Block Modules: Integral with connector a body, including plug and jacks where indicated.

2. IDC Connecting Hardware: Consistent throughout Project.

D. Jacks and Jack Assemblies for UTP Cable: Modular, color-coded, RJ-45 receptacle units with integral IDC-type terminals. Provide Leviton 41089041P Faceplates with color coded Leviton 61110 Jacks

E. Workstation Outlets: Multiple jack/connector assembly mounted in a single gang faceplate.

1. Faceplate: High-impact modular white or ivory ABS plastic.
2. Mounting: Semi-flush, except as otherwise indicated. All unused mounting spaces shall be equipped with a blank insert.
3. Legend: Provide jacks in color corresponding to those specified above under “Color Codes”. Label jacks in accordance with the specifications listed in this document. Provide facilities for insertion of machine printed jack identification label behind plastic cover. Install machine printed labels at each jack location.

F. Patch Cables : Provide one patch cord for every data and voice termination. Patch cords shall be Cat 6 by Panduit UTPSPxx or Commscope UNC6-xx-yyF. Provide color and length per Baltimore County direction.

2.2 FIBER OPTIC SYSTEM

A. Provide riser rated indoor fiber optic cable as indicated on the telecom riser on the drawings. Provide Commscope optical fiber.

B. Provide rack mounted fiber termination enclosure fully loaded , with “LC” type connectors. Fiber Optic Patch panels shall permit the use of pre-terminated or on-site terminated fiber optic cables. Cables shall be managed using the included retaining clips. Provide Commscope 4U-RFE-FXD-EMT-BK/4U in MDF Racks and Commscope 2U-RFE-SLG-EMT-2U in IDF Racks.

C. All cable installed must be pre-approved by the Baltimore County Office of Information technology prior to installation.

2.3 DATA/VOICE PATCH PANELS

A. Patch Panels shall be ANGLED 48 port, Category 6 TIA/EIA-568-B, Panduit – UICMPPA48BL , CommScope – M2000A-48 or equivalent approved by Baltimore County Office of Information Technology.

B. Data Patch Panels shall be angled modular panels consisting of multiple numbered jack units with connectors of the IDC type at each jack to provide permanent termination of conductor pair groups of installed cables. Patch Panels shall be Category 6 48 port as required to provide the necessary number of ports for the installation plus at least 20% spare ports (minimum fifteen (15) empty ports) for future expansion.

C. Panels shall be mounted in equipment cabinets or racks, with one(1) 2U horizontal cable management bracket per patch panel, and vertical cable management where appropriate.

1. Chatsworth Products (for vertical tray) model 30162-703.
2. Panduit (for horizontal tray) Model 1U-NCMHF1.

2.4 EQUIPMENT RACKS/CABINETS

A. Wiring Closets and Main Data Room

1. Refer to Specification Section 16820 “Communications Equipment Room Fittings” for equipment rack specifications.

2. Rack/Wall mount LIU for Fiber Optic Cabling termination. LIU’s should be sized to provide for 20% additional growth.

3. All rack equipment that is to be installed shall be pre-approved by the Baltimore County Office of Information Technology.

2.5 VOICE SYSTEM

A. Voice horizontal CAT6 cabling shall be identical to Data horizontal CAT6 cabling. Terminate voice cables on 48 port CAT6 patch panels. Conforming to the TIA 568-B wiring pattern.

B. Provide multi-pair voice riser rated copper voice backbone cable from the new main telephone room to each telecom room. Voice backbone cables shall be Panduit P110KB100x, , Commscope UNK-110-WB-5M-xxx, or approved equal.

C. Terminate copper voice backbone cable on 110 blocks at each end. Voice Termination Punchblocks shall be AT&T 110-300 or approved equal. Provide a sufficient quantity of the required 110 type hardware to terminate all voice backbone cables being installed under this contract. Provide all required stand-off brackets, D-Rings, and cable dressing hardware to provide, a neat and workmanlike installation.

2.6 VIDEO OUTLETS, CABLES, AND MISCELLANEOUS EQUIPMENT

A. Video (RF) Jacks shall be standard "F" connector feed through type jacks, Ortronics 6090017 or approved equal. Each jack shall be fed by an RG6 coaxial cable. Coil twenty (20) foot service loop at existing telephone backboard for connect to cable television service by Comcast Cable Television. Tag each cable as to location served.

B. Video Drop Cable shall be a plenum rated quad shielded RG-6 coaxial cable with an 18 AWG solid copper center conductor, a 100% Bi-foil shield and a 65% aluminum braid shield. Video drop cable shall be Commscope 2275V or approved equal.

C. Video System RG-6 Connector shall be a two-piece crimp on type. Provide Blonder Tongue BTF-561 or approved equal.

D. System Tap offs shall be Toner Model TGT four (4) and/or eight (8) port Tap offs or Blonder-Tongue Model SRT-4A four (4) and SRT-8A eight (8) port Tap offs.

E. Provide input cable from Utilities Demarq to MDF. Input cable shall be Time Fiber TX Series Flexible Feeder model # 02852V TX15AQ-VBV Flame Retardant Quad Shield terminated with Amphenol ACC-15BAFFT10U or Gilbert G-15Q-BAFF TX Quad connectors specific to this cable.

F. Provide riser video cable from MDF to each IDF. Riser video cable shall be Time Fiber TX Series Flexible Feeder model # 02852V TX15AQ-VBV Flame Retardant Quad Shield terminated with Amphenol ACC-15BAFFT10U or Gilbert G-15Q-BAFF TX Quad connectors specific to this cable.

G. Provide a minimum of one (1) Blonder-Tongue model #5800P-73 BIDA 75A-30P 5-36,49-750MHz WITH Integrated Active Return Broadband Indoor Distribution Amplifier in the Head End (MDF) (as a launch amplifier) and one (1) in each building sub-closet (IDF) to provide a fully functional catv system. Provide necessary internal pads and equalizers to balance the installed system.

PART 3 – EXECUTION

3.1 EXAMINATION:

A. Examine pathway elements to receive cable. Check raceways and other elements for

compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Do not proceed with installation until all conditions have been deemed satisfactory.

3.2 INSTALLATION COPPER BASED CABLES:

A. Wiring Methods:

1. Extend a minimum of two data station cables from each jack to the location indicated in the Schedule of Telecommunications Outlets on the drawings, and terminate on Category 6 patch panel.

2. Extend a minimum of three station CAT6 cables from each standard outlet (containing three CAT6 jacks) to the location indicated on the drawings, and terminate on Category 6 patch panel.

B. Termination of voice and data station cables shall be in accordance with EIA/TIA 568A, Designation T568B for Category 6 cable. Verify jack termination scheme with Baltimore County Office of Information Technology.

C. Install components as indicated, according to manufacturers' written instructions. Use techniques, practices, and methods that are consistent with the Category 6 rating of the components and that assure Category 6 performance of completed and linked signal paths, end-to-end.

D. Install cable without damaging conductors, shield, or jacket.

E. Do not bend cable in handling or installation to smaller radii than minimums recommended by manufacturers.

F. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

G. Pull cables simultaneously where more than one is being installed in the same raceway or cable run.

H. Use pulling compound or lubricant where necessary. Use compounds that will not damage conductor or insulation.

I. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway.

J. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

K. Secure and support exposed cable at intervals not exceeding 30 inches and not more than 6 inches from boxes, cable trays, fittings, racks, frames, and terminals.

L. Separation of Wires: Comply with EIA/TIA-569 rules for separation of unshielded copper voice and data system cables from potential EMI sources, including electrical power lines and equipment.

M. Make splices, taps, and terminations only at outlets, terminals, and cross-connect and patch panels.

N. Use splice and tap connectors compatible with media types.

3.3 INSTALLATION FIBER OPTIC CABLES

A. Multimode Fiber - Installed cable shall be 50 micron core/cladding, enhanced grade, multimode, and graded index glass fiber. All materials in the cable shall be dielectric.

1. Performance: Installed fiber must meet or exceed the performance specifications laser optimized firer optic cabling.

2. Cable Construction: Installed cable must be manufactured to meet or exceed the following specifications:

a. Plenum Cable (Inside Cable): Plenum rated cable shall be used for all interior installations. Installed cable shall meet or exceed the following specifications:

1) Tight buffered 900 um, mechanical strippable Teflon (for plenum applications).
2) EIA/TIA -598 color coding for fiber optic cable.
3) Aramid yarn strength member, capable of supporting a short-term tensile load of 400 lb. without stretching.
4) Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
5) Capable of a minimum crush resistance of 850 lb./in.

b. Outside Plant Cable: Outside plant cable shall be used for all applications where cable is to be run in underground conduits. Outside plant cable may not be used or interior applications and shall meet the following specifications:

1) Gel filled buffer tube, 250 um, acrylate.
2) EIA/TIA-598 color coding for fiber optic cable.
3) Flooded core
4) Capable of bend radii as small as 20 x outside cable diameter (under installation Load) and 10 x outside cable diameter (long term load).
5) Capable of a minimum crush resistance of 850 lb./in

B. Single Mode Fiber: Installed cable shall be 8.3/125 micron core/cladding, single mode, and graded index glass fiber. All materials in the cable are to be dielectric.

1. Performance: installed fiber must meet or exceed the following performance specifications.

Fiber cable types	Wavelength (nm)	Max. Attn. (dB/Km)
Singlemode, Inside plant	1,310	1.0
	1,550	1.0
Singlemode, Outside plant	1,310	0.35
	1,550	0.2

2. Cable Construction: Riser or plenum rated cable shall be used for all interior installations. Installed cable shall meet or exceed the following specifications:

a. Riser or Plenum (Inside Cable): Riser cable shall be used for all interior installations and shall meet the following specifications:

1) Tight buffered 900 um, mechanical strippable Teflon.
2) EIA/TIA -598 color coding for fiber optic cable.
3) Aramid yarn strength member, capable of supporting a short-term tensile load of 400 lb. without stretching.
4) Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
5) Capable of a minimum crush resistance of 850 lb./in.

b. Outside Plant Cable: Outside plant cable shall be used for all applications where cable is to be run in underground conduits. Outside plant cable may not be use for interior applications and shall meet the following specifications:

1) Gel filled buffer tube, 250 um, acrylate.
2) EIA/TIA -598 color coding for fiber optic cable.
3) Flooded core
4) Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
5) Capable of a minimum crush resistance of 850 lb./in.

C. Fiber ends are to be terminated in SC-type connectors with composite ferrules. They must be of the "epoxy and polish" variety.

3.4 INSTALLATION AT EQUIPMENT ROOMS AND WIRING CLOSETS

A. Provide adequate length of conductors and cables. Train the conductors to terminal points with no excess. Provide a minimum of ten (10) feet of service loop for all cables within Equipment Room, but not inside of rack enclosure. Use cable management system to restrain cables, to prevent straining connections, and to prevent bending cables to radii smaller than allowed.

B. Mount voice punch blocks, terminal strips, and other connecting hardware on plywood backboards, except as otherwise indicated. Provide additional ¾” fire retardant treated plywood backboards where required for mounting of equipment.

C. Mount data patch panels in floor or wall mounted electronic racks, with cable management. Do not fill racks to more than 66% capacity to allow room for owner furnished equipment. Provide additional racks, to match existing, where required to maintain rack space.

D. Group connecting hardware for cables into separate logical fields.

E. All unarmored fiber cable is to be protected with inner duct. After installation, inner ducts are to be permanently labeled as containing fiber optic cable. Instruction for labeling will be provided by Baltimore County Office of Information Technology.

3.5 IDENTIFICATION

A. Labels at corresponding ends of each cable must be consistent and accurate.

B. Data Cabling:

1. Data patch panels shall be labeled alphabetically beginning with “A” from top to bottom of the equipment rack. Letters shall not be repeated within the same wiring closet.

2. Data station terminations shall be labeled with their corresponding wiring closet room number, where applicable, patch panel letter and port number.

C. Voice Cabling:

1. Voice termination blocks shall be numbered sequentially. Numbers shall not be repeated within the same wiring closet.

2. Voice station terminations shall be labeled with their corresponding block number. For installations where 2 voice lines are being split from one cable, the voice jack containing the Blue and Orange pairs shall be labeled with the corresponding number as well and the letter 'A', and the jack containing the Green and Brown pairs shall be labeled with the corresponding number as well as the letter 'B'.

D. Fiber Optic Cabling: Each cable and inner duct is to be permanently labeled at each end with a unique cable number. In addition, labels shall be affixed to the cable/inner duct at every transition of a vault, hand hole, riser closet, or major pull box.

3.6 SLACK

A. In the work area, a minimum of 300 mm (12 in) should be left at outlets, while 1 m (3 ft) be left at the backboard or rack, and 6 m (20 feet) in the closet area.

B. In telecommunications rooms a minimum of 10 m (33 ft) of slack should be left for all cable types. This slack must be neatly managed on trays or other support types. "All cable types" includes all voice/data/video backbone cables and fiber optic backbone cables.

C. All unused cables shall be properly terminated, as specified, with 10 m (33 feet) extra cable neatly coiled and tie-wrapped at the workstation end of cable in the ceiling space.

D. Where wireless access point devices are installed, provide a minimum of 3 m (10 feet) of cable coiled, tie-wrapped, and supported in the ceiling space.

3.7 CABLE TIE WRAPS

A. Tie wraps shall be used a appropriate intervals to secure cable and to provide strain relief at termination points. These wraps shall not be over tightened to the point of deforming or crimping the cable sheath. Tie wraps shall be attached with screws to walls, backboards, and other structures. Tie wraps shall be spaced between 6" and 10" apart, 8" on the average.

B. Hook cable managers should be used in the IDF/MDF room where reconfiguration of cables and terminations may be frequent. Cable Managers shall be Polygon Softcinch Series, or approved equal.

C. No "stick-on" cable wraps, raceways, or terminal devices are acceptable.

3.8 SYSTEM ACCEPTANCE TESTING

A. The Cable System Installer shall document the cable system testing methodologies in detail, including the scope, procedures and acceptance criteria for testing. The testing process shall be comprised of the test cycles outlined below. All test results (e.g. cable lengths, test result values, etc.) shall be documented in both hard copy and electronic format for review and approval by the Baltimore County Office of Information Technology. Test results should be e-mailed to

nsuinfo@baltimorecountymd.gov. Electronic format shall be provided using one of the products available in the Microsoft Office Suite (Word, Excel, etc.), and shall be provided on CD-ROM.

B. The Cable System Installer shall provide all necessary diagnostic tools (i.e. Optical Time Domain Reflectometer (OTDR), cable scanner, meters, logging equipment, etc.) The Cable System Installer shall describe any testing tools that are used, along with the capabilities and limitations of these tools.

C. Cable System testing shall be conducted after installation is complete. Upon completion of all prerequisite tasks to the corresponding test, the Cable System Installer shall notify the Baltimore County Office of Information Technology, in writing, that the relevant portion of the cabling system is complete and ready for inspection.

D. Acceptance Test Guidelines:

1. All copper cabling and terminations shall be tested, characterized and documented. At a minimum, the following tests must be performed:

a. Continuity Testing shall be performed to determine that the copper conductors are continuous with no opens or shorts.

b. Cable Characteristic Testing shall be performed to measure the intrinsic characteristics of a copper cable segment. Information derived from this test shall include the cables near end crosstalk (NEXT), capacitance, and characteristic impedance. This test shall be conducted on all installed end-to-end cable sections.

c. Time Domain Reflectometer (TDR) shall be used to evaluate copper loss per unit length (Db/ft) to measure both the quality and length of copper cable. The TDR information shall be used to verify that the cable meets required IEEE 802.3 specifications for 1000BaseT connections over unshielded twisted pair cable.

d. Termination Testing shall be performed after the cable has been installed to verify that all cable pairs have been properly terminated. This testing shall assure that the pin-outs are correct and that there have been no flipped or incorrectly terminated pairs.

e. Link Confidence Testing shall measure the copper cables ability to support 1000 Mb/s (Gigabit Ethernet).

f. The matrix below defines when each of the above tests shall be performed:

Copper Cable Test Requirements				
Unit Test Name	On-Reel	After Install	Post Term.	Final Test
Continuity Test		!	!	
Cable Characteristic Test				!
Time Domain Reflectometer (TDR)			!	!
Termination Testing			!	!
Link Confidence Test @100 Mb/s			!	!
Link Confidence Test @1000 Mb/s			!	!

2. All single mode and multi mode fiber strands shall be tested end-to-end for bi-directional attenuation, and 1310 nm/1550 nm for single mode fibers. Tests should be conducted in compliance with EIA/TIA-526-14 or OFSTP 14, Method B, according to the manufacturer's instructions for the test set being utilized.

   a. After termination, each fiber shall be tested with an ODTR for length, transmission anomalies, and end-to-end attenuation. Results are to be recorded and supplied to the Baltimore County Office of Information Technology in the form of hard-copy printouts.

   b. After termination and bulkhead mounting, each terminated fiber is to be tested for end-to-end loss with a power meter/light source. As above, results are to be recorded and supplied to Baltimore County Office of Information Technology.

   c. The maximum allowable attenuation for any splice or termination is 0.3 dB.

D. CATV System Acceptance Tests:

1. Coaxial Cable Plant Testing shall consist of a sweep test of the cable plant provided under this Contract to verify installed cable bandwidth and distortions.

2. A Cumulative Leakage Index (CLI) survey shall be made to verify system integrity. Section 76.605(a)(h) of the FCC states that signal leakage must not exceed 20 micro-volts/meter from 54 MHz to 216 MHz at 3 meters and 15 micro-volts/meter at all other frequencies.

3. The Contractor shall test and for the following:
   a. Test all specialty video cables for open, short, and ground.
   b. Test all specialty video cables for end to end signal performance.
   c. Test picture quality at each specialty outlet.
   d. Test cables for frequency response and insertion loss at 5-1000 MHZ.

3.9 CLEANING

A. On completion of system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

3.10 DOCUMENTATION:

A. The conditions of the General Provisions (General, Supplementary, and other Conditions) and the General Requirements are hereby made a part of this Section.

B. A comprehensive installation, operation, programming and instruction manual shall be supplied as part of the system. The manual shall provide complete service information, including schematics, layout drawings, and interconnecting diagrams showing the location of all the outlets, cable taps, cable routes, and other installed components. Include final revised one-line system drawings. Include for this particular project parts lists to permit quick and efficient maintenance and repair of the equipment by qualified technicians. Manuals shall include 8-1/ 2" x 11" device location/cabling route drawings provided in CADD format Autodesk -AutoCadd Release 2010 or later (.dwg/.dxf) on CD disk. Manuals shall include a copy of the operations manuals listed below. Manuals shall be indexed and placed in a hard-cover three ring binder. Three (3) copies of this manual shall be provided to the Owner upon project completion. Contractor shall retain a minimum of one (1) copy for their permanent records. Provide one copy of Manual and disk(s) in the Main Equipment Rack. Refer to “General Provisions” in the contract for additional requirements or for documentation requirements.

3.11 DRAWINGS

A. As-built drawing shall be provided by the Contractor, in compliance with EIA ANSI/TIA/EIA-606, showing the locations of and identifiers for all:
1. Horizontal cable routing and terminations.
2. Telecommunications outlets/connectors, Telco System interfaces.
3. Backbone cable routing and terminations and outlets.
4. Video cable routing and terminations and outlets.
5. Data cable routing and terminations and outlets.
6. Electrical power cable routing and terminations, power outlet locations.
7. Network cabling plans identifying type, number, and location of equipment and outlet.
8. Cable penetration details, schematic riser diagrams, and equipment closet layouts.

B. Provide as-built drawings to include cabling routing, details of station and hardware locations, etc. The Contractor shall provide as-built drawings on CD disk in AutoCAD (.dwg/.dxf) file format. Contractor will have access to drawings provided with this specification where they are in electronic form.

C. Provide a set of “As-Built” Drawings encased in a plastic sheet protector at backboard, in each wiring closet.

D. At the completion of the project, the Contractor shall bring the system wiring diagrams fully up to date with the actual field installation, showing all field-made changes for deviations from the approved shop drawings. Accurately record location of service entrance conduit, termination backboards and cabinets, outlet boxes, messenger cable raceways and cable trays, pull boxes and equipment. Room names and numbers shall be updated to indicate actual field-assigned room numbers. They may not necessarily be the room names and numbers shown on the Contract Drawings.

3.12 RECORDS

A. All records shall be created by the installation contractor and turned over at the completion of work. The format shall be computer based and both soft copies and hard copies shall be part of the As-built package. The minimum requirements include:

B. Cable records shall contain a complete listing of the identifier, cable type, length, pair status, pair assignment, termination positions at both ends, manufacturer, and part number.

C. Connecting hardware records shall contain the identifier, type of hardware and the amount of positions.

D. Connecting hardware positions records shall contain the identifier, type of position, and the cable identifier attached to it.

E. Test documentation on all cable types shall be included as part of the As-built package.

F. Outlet Records: Provide a database of outlet designations capable of being exported to a cable management software system (xls format). The Contractor shall provide a complete database indicating the location of each outlet and corresponding port on wire closet equipment.

G. Provide a complete Owner's Manual including full documentation of system paths and components to allow for plug and play operating cable management, cable maintenance, and cable modifications. Commercial off-the-shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of this section.

END OF SECTION 27 50 00

SECTION 275123

PUBLIC ADDRESS AND INTERCOM SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. The intent of this specification is to provide complete and satisfactory operating systems for the pickup, amplification, distribution, and reproduction of paging material.

B. This specification is based on equipment manufactured by Peavey, Crown, Atlas Sound and other manufacturers of like reputation and quality. Equipment substitutions will be accepted only if submitted at least ten (10) days prior to bid date. The Engineer shall review any requests and recommend action to the Architect and Owner. Equipment that is judged as inferior, insufficient, or discontinued models shall not be acceptable. The contractor shall provide the required number of complete sets of the following: submittals, shop drawings, rack layouts, patch bay assignments, as-built drawings, instruction manuals for all equipment, and service manuals for all equipment.

C. The system shall be guaranteed for a period of two (2) years from the date of acceptance against defective materials, workmanship and improper adjustment. Any defective material shall be replaced with no charge to the owner, provided it does not show abuse.

D. If the installation is to take place in an OCCUPIED building, the installing contractor may be required to take additional precautions for the security of material and equipment, as well as additional precautions to ensure the absolute safety of the school's students, faculty and administration.

E. The specifying authority retains the absolute right to immediately remove from the project any individual or contractor whose work habits, in the specifying authority's sole judgment, are endangering others, or who is acting in an unprofessional manner towards members of the student body and/or others.

F. To assure compliance with all governmental codes, regulations, and laws, the installing contractor shall have on its staff a Master Electrician licensed within the State of Maryland. Proof of such licensing shall be included with the contractor's submittal.

G. To assure compliance with all industry and governmental standards and policies, the installing contractor shall have on its staff a BiCSi Registered Communications Distribution Designer. Proof of such registration shall be included with the contractor's submittal.

H. The contractor shall have an ICIA Certified Technical Specialist (CTS) on staff

I. All equipment, except portable equipment, shall be held firmly in place. This shall include loudspeakers, projection equipment, cables, rack enclosures, etc. All switches, connectors, cable, etc. shall be clearly, logically and permanently marked during installation. Markings shall be engraved directly on the required surface, or on "grav-o-ply" plastic, or hot-stamped on heatshrink. Cabling inside equipment racks and large surface raceway shall be secured at six (6)- inch intervals. Wiring shall be carried out according to the standards found in Sound System Engineering by Don & Carolyn Davis (Howard W.Sams and Co., catalog #21857).

J. Carefully examine the contract documents, the blue prints, and/or the installation site for omissions, existing conditions and general hands-on knowledge. The Contractor shall

provide a complete system that fully meets all conditions defined throughout this specification. The contractor must interface with the Electrical Engineer, the Electrical Contractor, the Mechanical Contractor, the Drywall/Finishing Contractor(s), and the General Contractor to: coordinate schedules, define device locations, separate conduit groups, install equipment mounts, and generally coordinate all other aspects of the project. The contractor shall be responsible to insure that the supplied equipment and it's installation meet the requirements set forth herein.

K. Bid submittals shall include the following:

1. Equipment list.
2. Drawings or cuts of all wall plates to coordinate with box types.
3. Block diagram of system.
4. Rack drawings
5. Test equipment list (see section 3.2)
6. Statement attesting bidder's experience in sound system design and installation for a period of five (5) years or more. This statement shall point out a job foreman and include detailed personal experience.
7. A list of three (3) similar sound system installations performed within the last two (2) years. Include owner/representative names and telephone numbers.
8. Copy of staff Electrician's Liscense and staff BiCSi Designers certification.
9. Copy of ICIA Certified Technology Specialist (CTS) certification.
10. Scaled Shop Drawings - All of the above drawings must be CAD generated in a format usable by AutoCAD. All Shop Drawings must be approved by a BiCSi Registered Communications Distribution Designer whose Official Seal and Registration Number must be affixed to each drawing. At the specifying authority's request, CD-ROMs containing the required drawings must be provided.

1.02 FUNCTIONS AND OBJECTIVES

A. Provide sound reinforcement of speech in the areas described. This reinforcement shall be in the form of actual sound from loudspeakers.

1.03 SCOPE OF WORK

A. The intent of this specification is to provide a complete and satisfactory operating system for the pickup, amplification, distribution, and reproduction of voice and/or audio program material. The system shall be of modular design to facilitate both expansion and service and shall be completely transistorized. All equipment and installation material required to fulfill the above shall be furnished whether or not specifically enumerated herein.

B. Work shall include the furnishing of all labor, material tools, and system described in these Specifications and shown in the system described in these Specifications and shown in the drawing. The work shall include, but not be limited to:

1. Installation of equipment rack, cabinet.
2. Internal wiring of rack.
3. Installation of speakers.
4. Wiring of all speakers.
5. Installation of microphone jacks and wire.
6. Making equipment function as intended.
7. Install priority override relays from the building intercom to seize the local speakers during an emergency all call.
8. Spectrum analysis and tuning of the system

9. Documentation of functions and wiring.
10. Documentation

C. Upon completion of the work, the contractor shall submit all as built drawings, including system single line block diagrams and wiring diagrams including all speaker line, microphone, rack interconnection, cabling, relay wiring and function and adjustment settings.

D. Sound Contractor shall also provide a complete set of manufacturer's specification sheets on all major items of equipment, including operating instructions, where relevant.

E. Additionally, the Sound Contractor shall dedicate no less than four working hours, upon completion of system to thoroughly familiarize owner's representative with all aspects of the system operation.

1.04 PERFORMANCE GUARANTEE

A. Sound Contractor unconditionally guarantees that the system delineated in this specification will meet or exceed the following performance criteria:

B. Maximum average program level shall be no less than 75 +/- 3 dB for all areas.

C. Each area / room shall have a uniformity of coverage within +/- 3 dB within the overall audience area.

D. Provide a minimum of four paging zones.

E. Interface with Owner provided telephone switch for intercom and paging announcements.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials specified herein shall be new and shall be the manufacturer's latest design, permanently labeled with the model number and serial number. The products specified are distributed through:

B. Provide intelligible, permanent identification on or adjacent to all controls; fuses and/or circuit breakers, connectors, receptacles, terminal blocks; amplifiers, equalizers, mixers, etc. The identification shall clearly indicate the function of the item and be numbered or lettered to correspond with the function, circuit, and/or locations, consistent with the field and shop drawings.

C. All devices connected to the electrical system and all auxiliary equipment necessary for the operation of the equipment associated with systems specified, herein shall be designed to operate from 105 to 130 volts, 60 Hz alternating current service, with stable performance, fully in accordance with these Specifications, and shall have integral fuse or circuit breaker protection.

2.02 SYSTEM COMPONENTS

A. The Amplifier shall be a 15 watt telephone paging amplifier Bogen TPU15 Pro or approved equal.

B. Four Zone (3 zone plus all call) Paging Routing Module – Bogen ZPM3 or approved equal.

C. The speakers shall be the Bogen S86 – T725 – PG8W or approved equal.

D. Provide a Loop Priority Kit to allow the intercom system control center override of the local sound system in the meeting room. Provide model LPC4MC.

E. Rack (for local sound system): Wall-mounted equipment rack shall be an Atlas-Soundolier model 324-15 with lockable door, Atlas SD7-145-052 storage drawer, Atlas ACRL-191B rack mounted power module and necessary blank panels as required, or approved equal.

2.03 WIRE

A. Provide West Penn 227, or equal, for the loudspeaker circuits.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractor shall be responsible for mounting and installing of all equipment specified herein. All conduit and hardware related to the conduit (i.e. boxes, supports, blank plates, etc.) shall be provided by others. All wire to support the Sound system, except AC power wire, shall be fully installed (pulled and terminated) by the Sound Contractor.

B. The equipment racks shall be fully assembled and tested in the contractors shop prior to delivery to the site. All wires that come into the equipment rack shall be terminated on barrier strips or quick-connect termination blocks specifically designed for stranded wire. Telephone-type 66 blocks shall not be acceptable for termination of stranded wire. Wires entering the equipment racks shall not connect directly to any equipment.

C. Install the wires entering the equipment racks in such a way as to allow re-adjustment of the rack location by the user. Use Cole-Flex XS100-type expandable braid sleeving around each bundle of signal wires and furnish six (6) foot loops that will rest off the floor when the rack is not pulled out into the room. Assure adequate strain relief of all wires.

D. Install different signal types in separate conduits. Run and bundle wire types in groups allowing separation of at least 12 inches between types. Do not run any signal wires in parallel to AC power cabling. Signal and AC power wires shall only meet and cross at right angles to each other. Coordinate with the Electrical Contractor to have conduits of like signal types grouped at Sound junction boxes, or run signal types separately in divided surface raceway between Sound junction boxes and the equipment racks.

E. Install the loudspeakers as depicted in the drawings. Follow the manufacturer's recommendations for rigging and support structures. The Contractor shall gasket each under-balcony baffle to prevent rattling and resonance between the ceiling and speaker

assembly. Pull speaker circuits through separate conduit from microphone or line level circuits.

F. Install microphone outlets as shown on the drawings. Wire all cables pin for pin with: shield on pin 1, hot or red on pin 2, and cold or black on pin 3. The outlet shall be a Soundolier S-501 with Switchcraft C3F, or equals. Pull microphone circuits through separate conduit from speaker or line level circuits. All microphone circuits shall be home run lines without splices.

G. Install remote volume controls as shown on the drawings. Do not splice wires, parallel connections only on approved terminal strips in enclosures or by neat and orderly soldering on connectors.

H. Fill all blank spaces in the equipment cabinet with panels of appropriate size. Provide security covers for all equalizers, delays, and other non-user preset controls.

I. Maintain a competent supervisor and supporting technical personnel during the entire installation. Change of supervision during the project is not acceptable without prior approval from the owner.

J. Furnish and install all materials, devices, components, and equipment required for complete, operational systems.

K. Rack Equipment installation:

1. Wire each rack as a unit to self-contained terminal strips.
2. Install all rack mounted equipment, devices, and materials in equipment rack in a logical, functional manner, demonstrative of signal flow within the respective system arranged for easy accessibility and convenient maintenance.
3. Utilize Equipment Racks including retaining devices and protective covers for run sheets, elevation and single-line drawing.
4. Run all line level wiring in the equipment racks on the equipment input side of the rack and all AC control, and speaker wiring on the output side of the rack.
5. Install an outlet strip with not less than 6 outlets ready to be served by its own branch circuit via a fourplex receptacle box at the base of the equipment rack.
6. Provide a separate ground lead from each amplifier chassis and from each of the other items of equipment normally requiring grounding to the rack ground bus.
7. Connect rack ground bus to isolated grounding buss by a single, green 12 TW stranded wire.
8. Shielded cables shall be grounded exclusively to isolated grounding bus.
9. Ground cable shields via a single path, tie to isolated grounding buss.
10. Signal Ground provisions shall realize less than 0.15 ohms to the primary ground connection.

L. Speaker Installation Procedures:

1. Provide and install positioning and support elements for loudspeaker assemblies where required. All such provisions shall be attached to and be wholly contained within the areas designated.
2. Arrange all positioning and support devices. Support elements for each of the loudspeaker components shall be independent and designed with a live load safety factor of at least five (5).
3. Verify that no loudspeaker assembly is subjected to stress, abrasion, or loading effects which could contribute to extraordinary failure.
4. Eliminate all conditions causing noise, rattle, or other extraneous sounds resulting from the operation of a loudspeaker assembly under any operation condition.

3.02 SYSTEM PERFORMANCE TESTS

A. Provide all required testing apparatus to complete the performance test of the system. Provide knowledgeable personnel to perform the testing.

B. Provide the following minimum test equipment:

1. Audio Toolbox or Audio Control SA-3050A with calibrated microphone and printer output options.

2. TEF 12+ or TEF 20 TDS analyzer or Audio Precision P1A.

3. Earthworks M30 microphone and preamplifier.

4. Sennheiser ZP-3 or Goldline ZM1 AC impedance bridge

5. HP 8903BDistortion analyzer

6. Oscilloscope

7. Sound level meter

8. Digital Multimeter

C. Measure and record the DC loop resistance of all microphone lines with a shorting plug installed in place of the microphone.

D. Check and correct the phasing of all loudspeakers.

E. Measure and record the impedance of all loudspeakers including the connecting wires. The values may be checked with the impedance meter but, the measurements shall made and recorded with the TEF analyzer, as recommended by the manufacturer, from 20 Hz to 20,000 Hz.

F. Measure and record the THD and noise level of each amplifier channel. Load the output with 8 ohm power resistors. Adjust controls for optimum signal-to-noise ratio and full amplifier output with a -50 dBm, 1 kHz sine wave at one microphone input. Measure and record the distortion level; the level shall be less than 1%. Substitute a 150 ohm resistor at the microphone input and measure and record the overall hum and noise at each amplifier output. The level shall be down at least 80 dB from the full output level from 20 Hz - 20,000 Hz.

G. Check for oscillation and radio frequency pickup. Set up system for intended usage, less any microphones. Use an oscilloscope on the speaker lines to monitor the output of the system. Insure that the system is free of spurious oscillation and RF pickup with no input signal and when driven to 75 dBA with a 500 Hz sine wave.

H. Check for and correct any rattles or buzzes. Apply a full range music source adjusted so that peaks are at specified minimum sound pressure level. Apply a swept sine wave from 100 Hz - 2,000 Hz at the specified average sound pressure level. There shall be no irregularities.

I. Adjust system levels so the limiter/compressor (or the mixer's integral limiter) activates just before clipping of any and all amplifiers. The limiter shall be turned "OFF" for all other tests. Reactivate and recheck the limiter after all other tests have been completed.

J. Adjust the digital delay line to a setting that provides the best time coherence between the visual source, speaker systems and hearing assistance system.

K. Measure and record, on the chart recorder, from at least three (3) representative positions, the "RAW" frequency response of the voice speaker system alone, without equalization. Repeat the above procedure for the program speaker system.

L. Equalize, measure and record the "EQUALIZED" frequency response of just the speaker system from at least three positions. The response shall be □3 dB of the following:
   1. Flat and even between 100 and 5,000 Hz.
   2. Fast rolloff (about 12dB per octave) below 50 Hz.
   3. Slow rolloff (about 3dB per octave) between 5,000 and 10,000 Hz.
   4. Fast rolloff (about 6-12dB per octave) beyond 15,000 Hz.

M. Measure the maximum output level of the system. Apply full range music adjusted so that peaks remain below the clipping level of the amplifiers. Measure the output level at peaks with the "fast" setting on the SLM. The audio system shall be able to deliver at least 105 dBA SPL to any audience position.

N. System Checking and Equalization

1. Preliminary checks and testing shall be conducted by the Sound Contractor prior to performance testing. Such procedures shall verify and insure proper operation of all components, devices, or equipment, nominal signal levels within the system, and the absence of extraneous or degraded signals. Preliminary checks shall include verification or the following:

   a. Proper grounding of devices and equipment. Proper provision of power to devices and equipment.
   b. Integrity of all insulation, shield terminations and connections.
   c. Integrity of soldered connections.
   d. Absence of solder splatter, solder bridges, debris of any kind, tools, etc
   e. Integrity of signal and electrical system ground connections.
   f. “Wire Checking” of all circuitry, including phase and continuity of all audio system distribution lines, with reference to running sheets, cable designation and submittal drawings.
   g. Sound contractor shall determine the proper sequence of energizing the system to minimize risk of damage to any components.
   h. After successfully energizing the system, the Sound Contractor shall make all preliminary adjustments, documenting the setting of all controls, parameters of all corrective networks, voltages at key system interconnection points, and device gains and losses, as applicable. All data shall be tabulated along with an inventory of test equipment, a description of testing conditions, and a list of test personnel.
   i. The Sound Contractor shall measure and record the unequalled or “raw” curve at no less than three sites in the reverberant field.

3.03 OCCUPANCY ADJUSTMENTS

A. On-site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions. Provide up to three on-site assistance visits within one year of Substantial Completion.

END OF SECTION 275123

SECTION 27 52 00

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this Section.

1.2 SUMMARY

A. Provide all materials and labor for the installation of a grounding and bonding system for communications infrastructure. This section includes requirements for providing a permanent grounding and bonding infrastructure for communications circuits, raceways, and cable tray.

B. Related Sections

1. Division 27 Section — "Conduit and Backboxes for Communications Systems"

2. Division 27 Section — "Communications Equipment Room Fittings"

1.3 REFERENCES

A. The applicable portions of the following specifications, standards, codes and regulations shall be incorporated by reference into these specifications.

1. General:

a. National Electrical Code (NEC)

b. National Electrical Safety Code (NESC)

c. Occupational Safety and Health Act (OSHA)

2. Communications:

a. TIA/EIA - 568: *Commercial Building Telecommunications Cabling Standard*

b. TIA/EIA - 569: *Commercial Building Standard for Telecommunication Pathways and Spaces*

c. TIA/EIA - 606: *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*

d. TIA/EIA - 607: *Commercial Building Grounding and Bonding Requirements for Telecommunications*

e. ISO/IEC IS 11801: *Generic Cabling for Customer Premises*

f. BICSI: *BICSI Telecommunications Cabling Installation Manual*

g. BICSI: *BICSI Telecommunications Distribution Methods Manual (TDMM)*

h. BICSI: *BICSI Customer-Owned Outside Plant Design Manual (CO-OSP)*

1.4 DEFINITIONS

A. "TMGB" shall mean *Telecommunications Main Grounding Busbar.* There is typically one TMGB per building, located in the main telecommunications room. This busbar is directly bonded to the electrical service ground.

B. "TGB" shall mean *Telecommunications Grounding Busbar.* There is typically one TGB per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems.

C. "TBB" shall mean *Telecommunications Bonding Backbone.* The TBB is a conductor used to connect TMGBs to TGBs.

1.5 SYSTEM DESCRIPTION

A. Furnish, install, and place into satisfactory and successful operation all materials, devices, and necessary appurtenances to provide a complete, permanent Grounding and Bonding infrastructure for communications circuits, raceways, and cable trays as hereinafter specified and/or shown on the Contract Documents. The Grounding and Bonding system shall support an ANSI/TIA/EIA and lSO/IEC compliant communications Structured Cabling System (SCS).

B. The work shall include materials, equipment and apparatus not specifically mentioned herein or noted on the plans but which are necessary to make a complete working ANSI/TIA/EIA and ISO/IEC compliant Grounding and Bonding system.

1.6 SUBMITTAL INFORMATION

A. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.

1. Submit a letter stating that the materials will be provided as specified, and specifically listing any items that will not be provided as specified. The letter shall also state that the Contractor has reviewed the specified items and agrees that they are applicable to this project in all respects.

2. For those items noted as allowing "or equal," and which are not being provided as specifically named, submit standard manufacturer's cut sheets or other descriptive information, along with a written description detailing the reason for the substitution.

3. Provide standard manufacturer's cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

B. Closeout Submittals: Provide submittal information for review as follows:

1. O&M Manual for Communications - At the completion of the project, submit O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to the Designer in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description.

2. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of redline markups of drawings, specifications and spreadsheets.

a. Document changes to the system from that originally shown on the Contract Documents and clearly identify system component labels and identifiers on Record Drawings.

b. Keep Record Drawings at the job site and make available to the Owner and Designer at any time.

c. Keep Record Drawings current throughout the course of construction. (“Current” is defined as not more than one week behind actual construction).

d. Show identifiers for major infrastructure components on Record Drawings.

1.7 SEQUENCING

1.8 CONTRACTOR WARRANTY:

A. Provide a Contractor-endorsed two-year service warranty against defects in materials and workmanship.

1. Provide labor attributable to the fulfillment of this warranty at no cost to the Owner.

2. The Contractor Warranty period shall commence upon Owner acceptance of the work.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall consist of busbars, supports, bonding conductors and other incidentals and accessories as required..

2.2 MATERIALS

A. Grounding/Bonding:

1. Telecommunications Main Grounding Bus Bar (TMGB):

a. Large (20” x 4” x ¼”), Pre-drilled: CPI 10622-020, or equal

b. Small (10” x 4” x ¼”), Pre-drilled: CPI 10622-010, or equal

2. Telecommunications Grounding Bus Bar (TGB):

a. Large (20” x 4” x ¼”), Pre-drilled: CPI 10622-020, or equal

b. Small (10” x 4” x ¼”), Pre-drilled: CPI 10622-010, or equal

3. Telecommunications Bonding Backbone: #6 AWG insulated (green in color) copper conductor.

4. Grounding Conductor: #6 AWG insulated (green in color) copper conductor.

B. Firestopping material: Conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions.

C. Labels: As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.

1. Hand-carried label maker:

a. Brady: ID Pro Plus (or approved equal).

2. Labels:

a. Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 -- REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

E. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

F. Install the grounding and bonding system in a manner ensuring that communications circuits, when installed, are able to fully comply with the ANSI/TIA/EIA and other references listed in Part 1 — References, above.

G. Remove surplus material and debris from the job site and dispose of legally.

3.2 INSTALLATION

A. The grounding and bonding infrastructure system shall not make use of the building plumbing system, unless required to do so by the NEC.

1. Coordinate the installation of the grounding and bonding system with the electrical power distribution system grounding infrastructure.

B. Ground/Bonding:

1. TMGB: Provide a minimum of one TMGB per telecommunications entrance room for each building and as shown on the Contract Documents. Install TMGB(s) and directly bond TMGB(s) to electrical service ground and to associated TBB(s). Group protector,

busbar bonding, and approved building grounding conductors toward one end of the TMGB and leave space for equipment grounding conductors on the other end.

2. TGB: Provide a minimum of one TGB per telecommunications room for each building and as shown on the Contract Documents and as required by the standards, references and codes listed in PART 1 -- REFERENCES above. Directly bond each TGB to its associated TBB and to the nearest building structural steel or other permanent metallic system. Group protector, busbar bonding, and approved building grounding conductors toward one end and leave space for equipment grounding conductors on the opposite end.

3. TBB(s) and Grounding Conductors: Provide TBB(s) and grounding conductors as shown on the Contract Documents and as required to bond all non-current carrying metal telecommunications equipment and materials to the nearest TGB. Use TBB(s) to connect the TMGB to each TGB. Route along the shortest and straightest path possible with minimal bends. Bends shall be sweeping. Insulate TBB(s) and conductors from their support. TBB(s) and grounding conductors shall be continuous (without splices).

    a. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic hardware.

C. Firestopping

1. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.

2. Maintain the fire rating of all penetrated fire barriers. Fire stop and seal all penetrations made during construction.

    a. Provide firestopping material for through and membrane penetrations of fire-rated barriers.
    b. Install firestops in strict accordance with manufacturer's detailed installation procedures.
    c. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer's recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply sealing material in a manner acceptable to the local fire and building authorities.
    d. For demolition work, apply firestopping to open penetrations in fire rated barriers where cable is removed. Apply firestopping regardless of whether or not the penetrations are used for new cable or left empty after construction is complete.
    e. Firestopping material used to seal open penetrations through which cable passes shall be re-usable/re-enterable.

D. Labels:

1. Label TMGB(s) with "TMGB"

2. Label TGB(s) with "TGB".

3. Label TBB(s) and bonding conductors "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

END OF SECTION 27 52 00

SECTION 275800

CONDUIT AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide all materials and labor for the installation of a pathway system for inside plant communications circuits. This section includes requirements for horizontal and building backbone raceways, fittings, and boxes specific to communications circuits (cabling) for voice and data.

B. Related Sections:

1. Division 27 Section — "Grounding and Bonding for Communications Systems"

2. Division 27 Section — "Inside Plant Communications Systems"

1.3 REFERENCES

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

1. General:

a. National Electrical Code (NEC)

b. National Electrical Safety Code (NESC)

c. Occupational Safety and Health Act (OSHA)

2. Communications:

a. ANSI/TIA/EIA - 568: *Commercial Building Telecommunications Cabling Standard*

b. ANSI/TIA/EIA - 569: *Commercial Building Standard for Telecommunication Pathways and Spaces*

c. ANSI/TIA/EIA - 606: *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*

d. ANSI/TIA/EIA - 607: *Commercial Building Grounding and Bonding Requirements for Telecommunications*

e. ISO/IEC IS 11801: *Generic Cabling for Customer Premises*

f. BICSI: *BICSI Telecommunications Cabling Installation Manual*

g. BICSI: *BICSI Telecommunications Distribution Methods Manual (TDMM)*

1.4 DEFINITIONS

A. “EMT” shall mean Electrical Metallic Tubing.

B. “RMC” shall mean Rigid Metal Conduit.

C. “SMR” shall mean Surface Metal Raceway.

D. “Raceway” shall mean any enclosed channel for routing wire, cable or busbars.

E. “TMGB” shall mean *Telecommunications Main Grounding Busbar.* There is typically one TMGB per building, located in the main telecommunications room. This busbar is directly bonded to the electrical service ground.

F. “TGB” shall mean *Telecommunications Grounding Busbar.* There is typically one TGB per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems.

G. “TBB” shall mean *Telecommunications Bonding Backbone.* The TBB is a conductor used to connect TMGBs to the TGBs.

H. “Pullbox” shall mean a metallic box with a removable cover, used to facilitate pulling cable through conduit runs longer than 100’ or in which there are more than 180 degrees of bends.

I. “Junction box” shall mean a pullbox wherein a feeder conduit transitions to multiple distribution conduits.

1.5 SYSTEM DESCRIPTION

A. Furnish, install, and place into satisfactory and successful operation all materials, devices, and necessary appurtenances to provide a complete Raceway system as hereinafter specified and/or shown on the Contract Documents. The Raceway system shall support an ANSI/TIA/EIA and ISO/IEC compliant communications Structured Cabling System (SCS) as specified in 271500 - Inside Plant Communications Systems

B. The work shall include materials, equipment and apparatus not specifically mentioned herein or noted on the Contract Documents but which are necessary to make a complete working Raceway system.

1.6 SUBMITTALS

A. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.

1. Submit a letter stating that the materials will be provided as specified, and specifically listing any items that will not be provided as specified. The letter shall also state that the Contractor has reviewed the specified items and agrees that they are applicable to this project in all respects.

2. For those items noted as allowing “or equal,” and which are not being provided as specifically named, submit standard manufacturer's cut sheets or other descriptive information, along with a written description detailing the reason for the substitution.

3. Provide standard manufacturer’s cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

B. Closeout Submittals: Provide submittal information for review as follows:

1. O&M Manual for Communications - At the completion of the project, submit all O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to the College in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description.

2. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of redline markups of drawings, specifications and spreadsheets, including maintenance hole/handhole butterfly drawings.

a. Document changes to the system from that originally shown on the Contract Documents and clearly identify system component labels and identifiers on Record Drawings.

b. Keep Record Drawings at the job site and make available to the Owner and Designer at any time.

c. Keep Record Drawings current throughout the course of construction. (“Current” is defined as not more than one week behind actual construction).

d. Show identifiers for major infrastructure components on Record Drawings.

1.7 CONTRACTOR WARRANTY:

A. Provide a Contractor-endorsed one-year service warranty against defects in materials and workmanship.

1. Provide labor attributable to the fulfillment of this warranty at no cost to the Owner.

2. The Contractor Warranty period shall commence upon Owner acceptance of the work.

1.8 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NEC, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NECA's "Standard of Installation."

C. Comply with NEC.

1.9 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall consist of conduit, surface metal raceway, outlet boxes, fittings, enclosures, pull boxes, and other raceway incidentals and accessories as required for inside plant communications circuits.

2.2 MATERIALS

A. Conduit:

1. EMT. 1” minimum conduit size. Flexible metal conduit (FMC) is not acceptable.

a. Conduit: Galvanized steel tubing meeting ANSI C80.3.

b. Couplings: Steel, cast iron, or malleable iron compression type employing a split, corrugated ring and tightening nut, with integral bushings and locknuts. Indent-type and setscrew-type couplings are not permitted.

2. RMC. 1” minimum conduit size.

a. Conduit: Hot dipped galvanized steel with threaded ends meeting ANSI C80.1.

b. Couplings: Unsplit, NPT threaded steel cylinders with galvanizing equal to the conduit.

c. Nipples: Same as conduit, factory-made up to 8 inches in diameter, no running threads.

B. Sleeves: EMT conduit, with insulated throat bushings for each end

C. Surface Raceway: Wiremold V2400 series or equivalent – Two piece, steel, single channel surface raceway.

D. Outlet boxes: Minimum 4”x4” size, 2 1/8” minimum depth, with extension rings (if needed) and single gang covers (i.e.; mud rings), unless otherwise noted on the Contract Documents. Combined interior depth of outlet box, extension ring and cover shall be a minimum 2-1/2”. Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for 1” trade size conduit or connector entrance, meeting NEMA OS 1.

1. Acceptable manufacturers:

a. Appleton, Raco, Steel City, or equal

2. Wiremold Extra Deep Switch and Receptacle Box: V5744-2 (two gang), or equal

E. Junction Boxes and Pull Boxes: Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance. Boxes 6”x6”x4” or larger may be code gauge fabricated steel continuously welded at seams and painted after fabrication.

1. Dry locations: meeting NEMA OS 1.

2. Wet locations: NEMA OS 3R.

F. Miscellaneous Fittings:

1. Locknuts and conduit bushings: Malleable iron

a. Appleton, Crouse Hinds, OZ Gedney, or equal

2. Through wall seals and floor seals shall be:

a. OZ Gedney FS and WS series, or equal.

G. Pull Strings: Plastic or nylon with a minimum test rating of 200 lb.

2.3 FIRESTOPPING

A. Material: Conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions.

2.4 LABELING AND ADMINISTRATION

A. Labels: As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, typed, and created by a hand-carried label maker or an approved equivalent software-based label making system. Handwritten labels are not acceptable.

1. Hand-carried label maker:

a. Brady: ID Pro Plus (or approved equal).

2. Labels:

a. Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal).

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 -- REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

E. Install the raceway system in a manner ensuring that communications circuits, when installed, are able to fully comply with the ANSI/TIA/EIA and other references listed in Part 1 — References, above.

F. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

G. Remove surplus material and debris from the job site and dispose of legally.

3.2 EXAMINATION

A. Examine surfaces and spaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions. Provide a raceway for each location indicated. Do not gang raceway into wireways, pullboxes, junction boxes, etc., without specific approval from the Designer.

B. Conduit:

1. Install EMT unless other conduit is shown on the Contract Documents or is required by Code.

2. Install conduit as a complete, continuous system without wires, mechanically secured and electrically connected to metal boxes, fittings and equipment. Blank-off unused openings using factory-made knockout seals.

3. Run conduit in the most direct route possible, parallel to building lines. Do not route conduit through areas in which flammable material may be stored.

4. Keep conduit at least 6 inches away from parallel runs of flues and steam or hot-water pipes or other heat sources operating at temperatures above one-hundred degrees Fahrenheit. Install horizontal conduit runs above water piping.

5. Keep conduit away from sources of electromagnetic interference as follows:

a. 5 inches from fluorescent lighting

b. 12 inches from conduit and cables used for electrical power distribution

c. 48 inches from motors or transformers

6. Do not exceed 90 meters total length for a given conduit run to be used for distribution cabling (from outlet box to telecommunications room), including intermediate conduits and junction boxes.

7. Install conduit exposed, except in finished areas or unless shown otherwise on the drawings. Do not install conduit below grade/slab unless specifically shown on the Contract Documents as being installed below grade/slab.

8. Install exposed conduit in lines parallel or perpendicular to building lines or structural members except where the structure is not level. Follow the surface contours as much as practical. Do not install crossovers or offsets that can be avoided by installing the conduit in a different sequence or a uniform line.

a. Run parallel or banked conduits together, on common supports where practical.

b. Make bends in parallel or banked runs from same centerline to make bends parallel.

9. Conduits concealed above ceilings, furred spaces, etc., which are normally inaccessible may be run at angles not parallel to the building lines.

10. Wherever practical, route conduit with adjacent ductwork or piping and support on common racks. Base required strength of racks, hangers, and anchors on combined weights of conduit and piping.

11. Where conduits cross building expansion joints, use suitable sliding or offsetting expansion fittings. Unless specifically approved for bonding, use a suitable bonding jumper.

12. Support conduits as specified in Section "Basic Electrical Materials and Methods."

    a. Provide anchors, hangers, supports, clamps, etc. to support the conduits from the structures in or on which they are installed. Do not space supports farther apart than five feet.

    b. Provide sufficient clearance to allow conduit to be added to racks, hangers, etc. in the future.

    c. Support conduit within three feet of each outlet box, junction box, gutter, panel, fitting, etc.

13. Ream conduits to eliminate sharp edges and terminate with metallic insulated grounded throat bushings. Seal each conduit after installation (until cable is installed) with a removable mechanical-type seal to keep conduits clean, dry and prevent foreign matter from entering conduits.

14. Install a pull string in each conduit.

15. For conduits entering through the floor of a telecommunications room, terminate conduits 6” above the finished floor.

16. Do not install communications conduits in wet, hazardous or corrosive locations.

17. Where conduit is shown embedded in masonry, embed conduit in the hollow core of the masonry. Horizontal runs in the joint between masonry units are not permitted.

18. Where conduit is shown embedded in concrete, embed conduit a minimum of two inches from the exterior of the concrete. Do not place conduit in concrete less than 4 inches thick.

    a. One inch trade size conduit shall be used. Conduits sized smaller than one inch trade size conduit are not permitted embedded in concrete without approval from the College.

    b. Run conduit parallel to main reinforcement.

    c. Conduit crossovers in concrete are not permitted.

19. Where conduit exits from grade or concrete, provide a rigid steel elbow and adapter.

20. Where conduit enters a space through the floor and terminates in that space, terminate the conduit at 6” above the finished floor.

21. Where conduits terminate at a cable tray, the conduits shall be consistently terminated no more than 8” from the cable tray, and have a visually uniform appearance.

22. Where several circuits follow a common route, stagger pullboxes or fittings.

23. Where several circuits are shown grouped in one box, individually fireproof each conduit.

24. Bend and offset metal conduit with standard factory sweeps or conduit fittings. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

    a. Conduit sweeps:

        1) Sweeps shall not exceed 90 degrees.

2) Do not exceed 180 degrees for the sum total of conduit sweeps for a section of conduit (between conduit termination points).

3) Sweep radius shall be at least 10 times the internal diameter of the conduit.

4) 90-degree condulets (LB's) and electrical elbows are not acceptable.

b. Factory-manufactured sweeps are required for bends in conduit larger than 1-¼" trade size.

c. For bends in 1 ¼" trade size conduit and larger, field-manufactured bends (using a hydraulic bender with a 1 ¼" boot) are permitted only when factory-manufactured sweeps are not suitable for the conditions. In all other cases, factory-manufactured sweeps are required. "Hickey-bender" use is prohibited.

25. Connect conduit to hubless enclosures, cabinets and boxes with double locknuts and with insulating type bushings. Use grounding type bushings where connecting to concentric or eccentric knockouts. Make conduit connections to enclosures at the nearest practicable point of entry to the enclosure area where the devices are located to which the circuits contained in the conduit will connect.

26. Penetrations for raceways:

a. Do not bore holes in floor and ceiling joists outside center third of member depth or within two feet of bearing points. Holes shall be 1-¼" diameter maximum.

b. Penetrate finished walls and finished surfaces with a PVC or sheet metal sleeve with an interior diameter (ID) at least 1/4" greater than the outer diameter (OD) of the conduit, set flush with walls, pack with fiberglass, seal with silicone sealant.

c. Penetrate poured-in-place walls and free slabs with a cast iron sleeve (or Schedule 40 PVC black pipe sleeve for above-grade only) with retaining ring or washer. Set sleeves flush with forms or edges of slab. Pack around conduit with fiberglass and seal with silicone sealant.

27. Raceway terminations and connections:

a. Join conduits with fittings designed and approved for the purpose and make joints tight. Do not use set indent-type or screw-type couplings.

b. Make threaded connections waterproof and rustproof by applying a watertight, conductive thread compound. Clean threads of cutting oil before applying thread compound.

c. Make conduit terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.

d. Cut ends of conduit square using a hand saw, power saw or pipe cutter. Ream cut ends to remove burrs and sharp ends. Where conduit threads are cut in the field, cut threads to have same effective length, same thread dimensions and same taper as specified for factory-cut threads.

e. Provide double locknuts and insulating bushings at conduit connections to boxes and cabinets. Align raceways to enter squarely and install locknuts with dished part against the box. Use grounding type bushings where connecting to concentric or eccentric knockouts.

f. Where conduits are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

28. Install conduit sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed conduits, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

    a. Where conduits pass from warm to cold locations, such as the boundaries of air conditioned or refrigerated spaces and where conduits enter or exit buildings from outdoor areas, including underground ducts or conduit runs.

    b. Where otherwise required by the NEC.

29. Conduit shall be clean and dry.

C. Sleeves:

1. Provide sleeves where required, sized as noted on the Contract Documents. Where not noted, sleeve sizing shall be determined by the type and quantity of cable to be routed through the sleeve per TIA/EIA 569A cable capacity standards, plus an additional 20% for future expansion.

2. Provide roto-hammering or core drilling where required for installation.

3. Seal between sleeve and wall or floor in which the sleeve is installed. Firestop all penetrations to restore wall or floor to pre-penetration fire-rating.

D. Surface Raceway:

1. Provide surface raceway for all surface mounted telecommunications outlet boxes and as shown on the Contract Documents.

2. Surface raceway shall be routed parallel to and perpendicular to surfaces or exposed structural members, and follow surface contours.

3. Surface raceway color shall match as closely as possible the existing wall finish. Do not paint Surface Raceway.

4. Surface raceway systems shall be completely installed, including insulating bushings and inserts as required by manufacturer’s installation requirements. Unused openings in the surface raceway shall be closed using manufactured fittings.

5. Surface raceway shall have a minimum two inch radius control at all bend points.

6. Surface raceway shall be securely supported by screws or other anchor-type devices at intervals not exceeding 10 feet and with no less than two supports per straight raceway section. Surface raceway shall be securely supported in accordance with the manufacturer’s requirements. Tape and glue are not acceptable support methods.

7. Mechanically and electrically continuous surface raceway shall be bonded and grounded to the Telecommunications Grounding system.

E. Outlet Boxes:

1. Provide outlet boxes and covers as shown on the Contract Documents and as needed. Verify that the appropriate cover type and depth is provided for each type of wall and finish. Provide extension rings as needed.

2. Coordinate box locations with building surfaces and finishes to avoid bridging wainscots, joints, finish changes, etc.

3. Install boxes in dry locations (not wet, corrosive, or hazardous).

4. Attach boxes securely to building structure with a minimum of two fasteners. Provide attachments to withstand a force of one hundred pounds minimum, applied vertically or horizontally.

5. Install boxes at the following heights to the bottom of the box, except where noted otherwise:

   a. Wall mounted telephones: 48” above finished floor.

   b. Workstation outlets: 18” above finished floor.

   c. Place boxes for outlets on cabinets, countertops, shelves, and similar boxes located above countertops two inches above the finished surface or two inches above the back splash. Coordinate and verify size, style, and location with the supplier or installer of these items prior to outlet box installation.

6. Recessed mounted outlet boxes:

   a. Recess boxes in the wall, floor, and ceiling surfaces in finished areas. Set boxes plumb, level, square and flush with finished building surfaces within one-sixteenth inch for each condition. Set boxes so that box openings in building surfaces are within one-eighth inch of edge of material cut-out and fill tight to box with building materials. Single gang opening shall extend at least to the finished wall surface and extend not more than 1/8 inch beyond the finished wall surface. Provide backing for boxes using structural material to prevent rotation on studs or joists.

   b. Install floor boxes level and adjust to finished floor surface.

7. Surface-mounted outlet boxes:

   a. For boxes surface-mounted on finished walls, provide Wiremold outlet box or equivalent. Cut box as necessary to accept conduit.

   b. For boxes surface-mounted on unfinished walls (i.e. electrical rooms, mechanical rooms), provide 4”x4” (minimum) outlet box with single gang cover.

F. Floor Boxes:

1. Provide floor boxes as shown on the Contract Documents.

2. Set device boxes plumb, level, square and flush with floor, within 1/16” tolerance for each condition.

3. For floor boxes with combined power and telecommunications circuits, provide metal dividers to separate power from telecommunications circuits.

G. Junction Boxes:

1. Provide junction boxes as shown on the Contract Documents and as required.

a. Where sizing is not shown on the Contract Documents, size junction box length and depth according to the size of the feeder conduit in the following table:

Feeder Conduit Size	Box Length	Box Depth
1”	12”	4”
1-¼”	12”	4”
1-½”	12”	4”
2”	24”	4”
2-½”	24”	6”
3	36”	6”
3-½”	48”	6”
4”	60”	6”

b. Where sizing is not shown on the Contract Documents, size junction box width according to the following formula:

1) From the table below, select the width associated with the largest conduit on the distribution side of the box. For each additional distribution conduit, add the “Increase Width” value associated with the size of that distribution conduit to the box width for the largest distribution conduit.

a) For example, if the distribution side of the junction box has one 1-¼” distribution conduit and three 1” distribution conduits, the total distribution-side width would be 6”+2”+2”+2”=10”.

2) Repeat the above process for the feeder side of the junction box. Junction boxes are typically fed by a single conduit, therefore unless the box has more than one feeder conduit, the “Increase Width” part of the formula is unnecessary.

a) For example, if the feeder side of the junction box has two 2” feeder conduits the total feeder-side width would be 8”+5”=13”.

3) The larger of the two width calculations (distribution side vs. feeder side) shall be the width of the junction box to be provided.

a) For example, if the distribution-side width were 10” and the feeder-side width were 13”, provide a 13” wide junction box.

Conduit Size	Box Width	For each additional conduit Increase Width
1”	4”	2”
1-¼”	6”	3”
1-½”	8”	4”
2”	8”	5”
2-½”	10”	6”
3	12”	6”
3-½”	12”	6”
4”	15”	8”

2. A junction box may not be substituted for a 90-degree bend. *90 degree condulets (LB’s) are not acceptable.*

3. Install junction boxes in a location readily accessible both at time of construction and after building occupation. Do not install junction boxes in inaccessible interstitial building spaces.

4. Where junction boxes are to be mounted on ceiling structure above ceiling grid, do not mount higher than 4’ above grid.

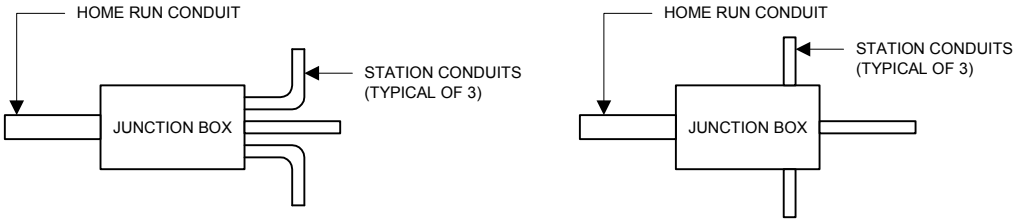
5. Install hinged-cover enclosures and cabinets plumb, and supported at each corner.

6. Install junction boxes so that the access door opens from the side where the cable installer will normally work – typically from the bottom (floor side) of the box.

   a. Where a junction box is installed in a ceiling space, coordinate with other trades to provide full access to the junction box door and adequate working room for both the installation personnel and for proper looping of cable during installation.

   b. Provide a lockable access cover (or junction box door if junction box is exposed) in hard lid ceilings.

7. Install junction boxes such that conduits enter and exit at opposite ends of the box as follows:



CORRECT INSTALLATION INCORRECT INSTALLATION

H. Pull Boxes:

1. Provide pull boxes as shown on the Contract Documents and as required.

a. Where sizing is not shown on the Contract Documents, size pull boxes as follows:

Size of Largest Conduit	Box Width	Box Length	Box Depth
1”	4”	12”	4”
1-¼”	6”	12”	4”
1-½”	8”	12”	4”
2”	8”	24”	4”
2-½”	10”	24”	6”
3	12”	36”	6”
3-½”	12”	48”	6”
4”	15”	60”	6”

b. Where a pull box is required with conduits 1” trade size or smaller, an outlet box may be used as a pull box. Where outlet boxes are used as pull boxes, the outlet boxes shall be dedicated for use as a pull box and shall not host cable termination hardware.

2. A pull box may not be substituted for a 90-degree bend. *90 degree condulets (LB’s) are not acceptable.*

3. Install pull boxes in an accessible location, readily accessible both at time of construction and after building occupation. Do not install pull boxes in inaccessible interstitial building space.

4. Where pull boxes are to be mounted on ceiling structure above ceiling grid, do not mount higher than 4’ above grid (mount on wall instead).

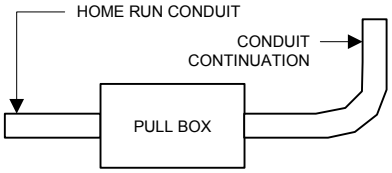
5. Install hinged-cover enclosures and cabinets plumb, and supported at each corner.

6. Install pull boxes so that the access door opens from the side where the cable installer will normally work (typically from the bottom, or floor side, of the box).

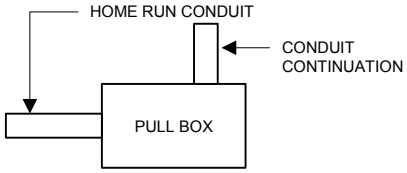
   a. Where a pull box is installed in a ceiling space, provide full access to the junction box door and adequate working room for both the installation personnel and for proper looping of cable during installation.

   b. Provide a lockable access cover (or pull box door if pull box is exposed) in hard lid ceilings.

7. Install pull boxes such that conduits enter and exit at opposite ends of the box as follows:



CORRECT INSTALLATION



INCORRECT INSTALLATION

I. Firestopping:

1. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.

2. Maintain fire rating of penetrated fire-rated walls. Firestop and seal each penetration made during construction.

   a. Provide firestopping material for through and membrane penetrations of fire-rated barriers.

   b. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.

   c. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer's recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply all sealing material in a manner acceptable to the local fire and building authorities.

J. Grounding/Bonding: Grounding and bonding work shall comply with the Virginia Uniform Statewide Building Code, Uniform Fire Code, National Electrical Code, and UL 467, ANSI/TIA/EIA standards and the references listed in PART 1 – REFERENCES above, as well as local codes which may specify additional grounding and/or bonding requirements.

1. Bond metallic raceway together and to the nearest TGB (as provided under Division 27 Section — "Grounding and Bonding for Communications Systems"). Ensure that bonding breaks through paint to bare metallic surface of painted metallic hardware.

3.4 LABELS:

A. Conduits: For any conduit extending beyond the space or room in which it starts, label each such conduit end in a clear manner by designating the location of the other end of the conduit (i.e. room name, telecommunications room name, pull box identifier, outlet identifier (use the label of the first port of the outlet as the outlet identifier), etc.). Indicate conduit length on the label.

1. Where a conduit is intended for future cabling use outside of the Contract, the conduit shall be labeled in a clear manner by designating the location of the other end of the conduit (i.e. room name, telecommunications room name, pull box identifier, etc.) along with a sequential number for each spare conduit terminated into a single room. Indicate conduit length on the label.

   a. Suggestion: The second spare conduit (whether spare or in use) between Room 100 and telecommunications room 1A might be labeled in the telecommunications room as "Room 100 - #2, __ feet." In Room 100 the same conduit might be labeled "1A - #2, __ feet."

B. Pull Boxes: Label each pullbox with a unique identifier. Identifiers shall be of the form “RN-Y” where “RN” is the room name of the room closest to (or containing) the pull box, and “Y” is the sequential number of the pull box for each “RN”.

1. Example: The second pull box in the vicinity of room “100” would have the label “100-2”.

C. Pull Strings: For any conduit extending beyond the space or room in which it starts, label its pull string in a clear manner by designating the location of the other end of the pull string (i.e. room name, telecommunications room name, pull box identifier, outlet identifier (use the label of the first port of the outlet as the outlet identifier), etc.).

1. Where a pull string is installed in a conduit intended for future cabling use outside of the Contract, the pull string shall be labeled similar to the spare conduit in which it is installed.

3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and in accordance with accepted industry practice, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.6 CLEANING

1. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 27 58 00

SECTION 27 60 00

TELEPHONE AND CATV UTILITY - INCOMING SERVICE PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the General Requirements, apply to the work specified in this section.

B. Division 16, Basic Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall provide all materials and labor required by the utility for service provisions.

B. The Contractor shall provide all materials and labor for complete empty conduit power, telephone and CATV distribution systems as shown on the drawings and as specified herein.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. General Electrical Requirements: Div 26

B. Basic Electrical Materials and Methods: Div 26.

C. Raceways and Boxes: Div 26.

E. Underground Ductbanks: Div 26.

G. Grounding: Div 26.

1.4 UTILITY COMPANY COORDINATION

A. Contact “Miss Utility” (1-800-257-7777) prior to any excavation or underground work. The Contractor shall verify the location and depth of all utilities. Provide test pits to verify location and depth of all existing utilities crossing new incoming services.

B. Contact serving utility companies immediately upon award of Contract. Do not install related equipment until fully coordinated with appropriate utilities.

C. Provide all Construction Schedules, dates of requested services, outage windows, equipment locations, etc., necessary for utility work.

D. The Contractor shall coordinate the electric and telephone services points of entry to be within twenty (20) feet (7.0 m), or as required to comply with NEC 800-11.

E. The Contractor shall ascertain, from the utility companies, the exact amount of work required in connection of the utilities. Work required which is not provided by the utility companies shall be provided by the Contractor.

F. Provide and coordinate all temporary services with utility companies.

G. The Contractor shall coordinate the required separation distances for all utilities.

H. The Contractor shall obtain al permits and permissions required.

1.5 SUBMITTALS

A. Certificate of Compliance: Contractor shall submit a documentation certifying that work complies with all utility company requirements including the following:
   1. Construction Standards of each Utility Company.
   2. Trench and cover Depth.
   3. Spacing and Support of Utilities.
   4. Installation of underground marking tape.
   5. Pull cords and Mandrels.

B. Photographs: Contractor shall submit photographs of each utility installation at each of the above described levels of completion and attach photographs to Certificate of Compliance for verification. Submit a minimum of six (6) color 4" x 6" photographs for each utility service.

C. Submit Certificate of Compliance and photographs to each utility company for verification and approval.

D. Include Certificate of Compliance, photographs, and utility company approvals in O&M Manual.

E. The Contractor shall provide and submit all required documentation to each utility company, including service application, site plan and coordination drawings.

1.6 QUALITY ASSURANCE

A. Comply with the requirements of Power Company ***Customer Requirements for Electric Service.***

B. Comply with the requirements of NFPA 70 National Electrical Code.

C. Comply with the NECA ***Standards of Installation***.

D. Comply with National Electrical Safety Code.

E. Contractor shall have experience with not less than 5 comparable projects for which the Contractor completed service provisions with each utility. Contractor shall be familiar with all current utility requirements and guidelines.

F. Comply with the recommendations and guidelines of ***the BICSI Outside Plant Design Reference Manual 5th Edition.***

G. Obtain utility company inspector's approval for all work.

PART 2 - PRODUCTS

2.1 TELEPHONE COMPANY PROVISIONS

A. The telephone utility is Verizon.

B. Telephone Service Wall Space: Provide a wall-mounted 3/4" fire-retardant painted plywood backboard, 8 feet high x 4 feet wide, as shown at location indicated on the drawings.

C. Provide adjacent to backboard two duplex convenience NEMA 5-20R receptacles connected to the [emergency] power system. Provide 2 #12 and 1 #12 ground in 3/4" conduit from receptacles to nearest 120 volt emergency power panel.

D. Provide adjacent to the backboard, one No. 8 copper ground conductor extended from the building's service ground point.

E. Provide one 50 pair telephone cable, plenum rated, (Belden or approved equal by West Penn) run concealed to the Owner's telephone system. Terminate cable in exact location and manner as required.

F. Provide conduit sleeves where cable is extended through partitions, walls, or floor slabs. Fire seal all openings after cable is installed.

G. Incoming Telephone service:
   1. Coordinate incoming telephone service requirements with area public telephone system utility. Provide two (2) 4" Schedule 40 PVC underground telephone service conduits from the telephone service equipment backboard to the vicinity of the power company's pad-mounted transformers or as indicated on the Drawings and terminate ducts in the exact location and manner as directed by the telephone company.
   2. Provide pre-cast pulling handholes in duct run in location(s) as directed if deemed necessary by the telephone utility. Size of handholes (L x W x H) shall be as required by the utility. Handholes installed in roadways shall be H20 roadway type.
   3. Extend two (2) 4" PVC Schedule 40 underground service conduits along with primary electrical feeder from power company transformer location to 5'-0" beyond property line, or as indicated on the Drawings, then capped and stubbed.
   4. In addition to the above requirements, install raceways in maximum lengths of 300 feet (90m) or as required by telephone company and a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

H. Coordinate incoming raceway with telephone utility company. Provide required conduit size as determined by the telephone company.

I. Coordinate for installation of pay telephones. Provide sufficient notice for telephone procurement and installation. Provide all necessary pay telephone rough-in provisions including 1" empty conduit from pay telephone location to main TTB and 120 volt power for ADA-required TTY unit.

J. Contractor shall be responsible for contacting and coordinating with the telephone company prior to ordering or installing any telephone entrance equipment and provisions.

2.2 CABLE TELEVISION COMPANY PROVISIONS

A. The Cable Television Company is Comcast.

B. Incoming CATV Service: Coordinate incoming CATV service requirements with the cable company. Provide two – 4" Schedule 40 PVC underground from the telephone service equipment backboard to the cablevision pedestal in the vicinity of the power company's pad-mounted transformers as directed by the Cable Company. Extend 2 - 4" Schedule 40 underground service conduit along with primary electrical feeder to 5'-0" beyond the property line, then cap and stub.

2.3 TYPICAL INCOMING SERVICE PROVISIONS

A. Pull Wire: 1/4" nylon pull cord with 500 lb. minimum tensile strength in each conduit.

B. Conduit, Elbows, and Couplings: UL Schedule 40, EB-35, DB-60, DB-120, or ANSI/ASTM F-512 as required by utility for the specific application.

C. Spacers: Every 4 feet of conduit.

D. Splice Boxes: Purchase from utility company. Provide as required.

E. Manholes: Purchase from utility company. Provide as required.

F. Underground Marking: Provide detectable warning tape over all conduits.

G. Bends: Minimum 5 foot radius (horizontal) and 36” radius (vertical).

H. Concrete for encasement: Minimum 3,000 psi or as noted on Drawing or as specified in Section 16300 “Underground Ductbank”, with air entrainment and pea gravel.

I. Backfill: Virgin soil/select backfill only. Backfill shall be stone dust, rock-free earth, or top soil with no stones larger than 1-1/2" in diameter permitted.

J. Miscellaneous Materials: Provide bushings, bell ends, conduit plugs and other miscellaneous materials as required by utility companies.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mandrel: Contractor shall pull a mandrel (1/2"' smaller in diameter than the conduit, and six inches long) through each conduit.

B. Pull Wires: Pull wires shall be left in all conduits, after mandrel pull.

C. Coordination: Coordinate location of telephone and CATV wall spaces, raceways, and boxes, as necessary, to interface installation of telephone and CATV systems with other work.

D. Bushings: Provide conduit bushing at each end of all conduits.

E. Bell Ends & Plugs: Provide Bell ends and plugs for each conduit.

F. Sealing Conduits: Provide duct sealant in each conduit after utility cable is installed.

3.2 PREPARATION

A. Contractor shall provide conduits at all street or road crossings for all utility facilities.

B. Provide a level area at final grade for all transformer, pedestal, and utility equipment locations.

C. Coordinate utility line separation requirements between electric, water, sewer, gas, telephone and CATV.

D. Contractor shall clear area for all utility cables of rubble, debris, stumps, and other obstructions.

END OF SECTION 27 60 00

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 28 05 00

COMMON WORK FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Communications equipment coordination and installation.
2. Common communications installation requirements.
3. Demolition
4. Waterproofing.
5. Weatherproofing locations.
6. Cutting and Patching.
7. Painting.
8. Equipment Foundations, Supports, Piers and Attachments.
9. Equipment Guards and Rails.
10. Cleaning, Protecting and Adjusting.
11. Welding.
12. Sleeves for raceways and cables.
13. Sleeve seals.
14. Grout.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

C. Wiring: Cable and/or wire installed in Raceway.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 WATERPROOFING

A. Where work pierces waterproofing, including waterproof concrete, the method of installation shall be approved by the Architect prior to performing the work. Furnish necessary sleeves, caulking and flashing required to make openings absolutely watertight.

1.6 WEATHERPROOFING LOCATIONS (WP)

A. Communication apparatus, such as outlet boxes, switches, connection panels, speakers, cameras, and other devices shall be weatherproof gasketed type, NEMA Types 3 or 4 in the following instances:

1. On surface of exterior face of building, including areas where not under canopies, cast boxes with threaded hubs must be used and under canopies steel boxes with gasket connections to devices.
2. In any areas where specifically noted "WP" or required by the NEC or Regulations mentioned herein.
3. Within air conditioning enclosures.
4. In underground splice boxes.
5. On building roof.
6. Within vivarium locations.
7. In unconditioned spaces subject to exterior ambient conditions such as loading docks and parking garages.

1.7 CUTTING AND PATCHING

A. Provide cutting and patching necessary to install the work specified herein. Patching shall match adjacent surfaces. Refer to Division 1, Cutting and Patching for specific directions.

B. No structural members shall be cut without prior approval of the Architect; such cutting shall be done in a manner directed by him.

C. Provide ceiling removal and replacement where work above ceilings is required. Replace ceiling components damaged in the process.

D. Provide patching where communications devices are removed from walls, ceilings or floors.

1.8 ACCESSIBILITY

A. Coordinate to ensure the sufficiency of the size of shafts, and chases, and the adequacy of clearances in hung ceilings and other areas required for the proper installation of this work.

B. Locate equipment which must be serviced, operated or maintained in fully accessible positions. Locations in ceilings requiring access shall be coordinated with, but not limited to lights, curtain tracks, and speakers. Equipment requiring access shall include, but is not necessarily limited to, motors, junction boxes, fire dampers, controllers, switchgear, etc.

C. Indicate the locations of access doors for each concealed device, concealed behind finished construction and requiring service on the coordination drawings. Equipment below floor slab or finished grade shall also be indicated on the coordination drawings.

D. Furnish access doors under this division for installation by General Contractor. Coordinate during bidding phase with General Contractor. Locations of access doors in finished construction shall be submitted in sufficient time to be installed in the normal course of the work.

1. Manufacturers: Subject to compliance with requirements, furnish access doors by one of the following:

a. Bar-Co., Inc.

b. J. L. Industries
c. Karp Associates, Inc.
d. Nystrom, Inc.

2. Materials and Fabrication:

a. General: Furnish each access door assembly manufactured as an integral unit, complete with all parts and ready for installation.
b. Steel Access Doors and Frames: Fabricate units of continuous welded steel construction, unless otherwise indicated. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of support shown.
c. Frames: Fabricate from 16-gauge steel.

1) Fabricate frame with exposed flange nominal 1 inch wide around perimeter of frame for units installed in the following construction:

a) Exposed Masonry

2) For gypsum drywall or veneer gypsum plaster, furnish perforated frames with drywall bead.
3) For installation in masonry construction, furnish frames with adjustable metal masonry anchors.
4) For full-bed plaster applications, furnish frames with galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

d. Flush Panel Doors: Fabricate from not less than 14-gauge sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175°. Finish with manufacturer's factory-applied prime paint.

1) For fire-rated units, provide manufacturer's standard insulated flush panel/doors, with continuous piano hinge and self-closing mechanism.

e. Locking Devices: Furnish flush, screwdriver-operated cam locks of number required to hold door in flush, smooth plane when closed.

1.9 PAINTING

A. Painting requirements of this section shall conform to Division 9.

B. Provide surface preparation, priming, and final coat application in strict accordance with manufacturer's recommendations.

C. Provide prime coat painting for the following:

1. Indoor miscellaneous steel and iron provided under this Division of the specifications.
2. Indoor hangers and supports provided under this Division of the specifications.

1.10 EQUIPMENT FOUNDATIONS, SUPPORTS, PIERS AND ATTACHMENTS

A. Provide necessary foundations, auxiliary steel, supports, pads, bases and piers required for equipment specified in this division; submit drawings in accordance with Shop Drawing Submittal requirements prior to the purchase, fabrication or construction of same.

B. Construction of foundations, supports, and pads where mounted on the floor, shall be of the same materials and same quality of finish as the adjacent and surrounding floor material.

C. Equipment shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature and any attachments that are, in the opinion of the Architect, not strong enough shall be replaced as directed, with no additional cost to the Owner.

1.11 CLEANING, PROTECTING AND ADJUSTING

A. Cleaning

1. General cleaning requirements are specified in Division 1.
2. Upon completion of the work, clean the exterior surface of equipment, accessories, and trim installed. Clean, polish, and leave equipment, accessories, and trim in first-class condition.

B. Protection of Surfaces

1. Protect new and existing surfaces from damage during the construction period.
2. Provide plywood or similar material under equipment or materials stored on floors or roofs. Provide protection in areas where construction may damage surfaces.
3. Surfaces damaged during the construction shall be repaired or replaced at the cost of the Contractor at fault. The method or repairing or replacing the surface shall be approved by the Owner and Architect.

C. Protection of Services

1. Protect new and existing services from damage during the construction period.
2. Repair, replace, and maintain in service any new or existing utilities, facilities, or services (underground, overground, interior, or exterior) damaged, broken, or otherwise rendered inoperative during the course of construction.
3. Services damaged during the construction shall be replaced at the cost of the Contractor at fault. The method used in repairing, replacing, or maintain the services shall be approved by the Owner and Architect.

D. Protection of Equipment and Materials

1. Equipment and materials shall be stored in a manner that shall maintain an orderly, clean appearance. If stored on-site in open or unprotected areas, equipment and material shall be kept off the ground by means of pallets or racks, and covered with tarpaulins.
2. Equipment and material, if left unprotected and damaged, shall be repainted or otherwise refurbished at the discretion of the Owner. Equipment and material is subject to rejection and replacement if, in the opinion of the Architect or the manufacturer's engineering department, the equipment has deteriorated or been damaged to the extent that its immediate use or performance is questionable, or that its normal life expectancy has been curtailed.
3. During the construction period, protect equipment from damage and dirt.

E. Adjusting

1. After the entire installation has been completed, make required adjustments to all systems until performance requirements are met.

1.12 SPECIAL TOOLS

A. Provide the Owner's representative with two (2) sets of special tools required for operation and maintenance of equipment provided.

1.13 WELDING

A. General Requirements

1. This paragraph covers the welding of systems. Deviations from applicable codes, approved procedures and approved shop drawings shall not be permitted. Materials or components with welds made off the site shall not be accepted if the welding does not conform to the requirements of this specification. Develop and qualify procedures for welding metals included in the work. Certification testing shall be performed by an approved independent testing laboratory. Bear costs of such testing.
2. Certified welders, previously certified by test, may be accepted for the work without re-certification provided that all of the following conditions are fulfilled:

    a. Submit copies of welder certification test records in accordance with this Division and Division 1 requirements.
    b. Testing was performed by an independent testing laboratory.
    c. The welding procedures and welders are certified in accordance with the "ASME Boiler and Pressure Vessel Code," and base materials, filler materials, electrodes, equipment, and processes conform to the applicable requirements of this specification.
    d. Certification has been within a one (1) year period from the start of the project.

3. Filler metals, electrodes, fluxes and other welding materials shall be delivered to the site in manufacturers' original packages and stored in a dry space until used. Packages shall be properly labeled and designed to give maximum protection from moisture and to assure safe handling.
4. Submit welding certificates for review. Each welder assigned to work covered by this specification shall be certified by performance tests using equipment, positions, procedures, base metals, and electrodes or bare filler wires.
5. Before assigning welders to the work, provide the architect with their names, together with certification that each individual is certified as specified. No welding work shall start prior to submissions. The certification shall state the type of welding and positions for which each is certified, the code and procedure under which each is certified, date certified, and the firm and individual certifying the certified tests.
6. Each welder shall be assigned an identifying number, letter, or symbol that shall be used to identify his welds. A list of the welders' names and symbol for each shall be submitted. To identify welds, either written records indicating the location of welds made by each welder shall be submitted, or each welder shall apply his mark adjacent to his weld using an approved rubber stamp or felt-tipped marker with permanent, weatherproof ink or other approved methods that do not deform the metal. For seam welds, identification marks shall be placed adjacent to the welds at 3 foot intervals. Identification by die stamps or electric etchers shall be confined to the weld reinforcing crown, preferably in the finished crater.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Coordinate piping systems installed at a required slope.

F. Apply for detailed and specific information regarding the location of equipment as the final location may differ from that indicated on the drawings. Outlets, equipment or wiring improperly placed because of failure to obtain this information shall be relocated and re-installed without additional expense to the Owner. Determine the actual direction of door swings, so that local switches and other controls shall be installed at the lockside of doors, unless otherwise noted. Improperly located switches shall be relocated without additional expense to the Owner.

G. The design shall be subject to such revisions as may be necessary to overcome building obstructions. No changes shall be made in location of outlets or equipment without written consent of the Architect and Owner.

H. Unless otherwise mentioned or indicated, mounting heights of outlets are shown on the drawings or in the specification. Dimensions given shall be considered to be from center of outlet to finished floor.

I. Coordinate the location and elevation of all communications devices and fixtures with the architectural interior elevation plan and reflective ceiling plan prior to installation.

J. Properly rough in for the communications raceways and equipment under this contract and modify as required for coordination during the construction period.

K. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

L. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section “Access Doors and Frames.”

M. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section “Penetration Firestopping.”

3.2 WELDING

A. Perform welding in accordance with qualified procedures using certified welders. Welding shall not be done when the quality of the completed weld could be impaired by the prevailing working or weather conditions. Welding of hangers, supports, and plates to structural members shall conform to AWS specifications.

B. Field bevels and shop bevels shall be by mechanical means or by flame cutting. Where beveling is by flame cutting, thoroughly clean surfaces of scale and oxidation just prior to welding. Beveling shall conform to ANSI B31.1 and AWS B3.0.

C. Replace and reinspect defective welds. Repairing defective welds by adding weld material over the defect or by peening shall not be permitted. Welders responsible for defective welds must be re-certified.

D. Store electrodes in a dry heated area, keep free of moisture and dampness during fabrication operations. Discard electrodes that have lost part of their coating.

3.3 SLEEVE INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS PENETRATIONS

A. Electronic Safety and Security Systems penetrations occur when raceways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, fire-rated floor, or wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

F. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

J. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

L. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.4 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 firestopping section.

3.6 DUST, DIRT AND NOISE

A. Carry out new work and make changes, relocations, and installations with a minimum of noise. Site areas and new equipment, floors and walls, shall be adequately protected from dust and dirt caused by the work. Protection shall include suitable temporary barriers or coverings. The exterior and interior premises of each building shall be kept clean as possible during construction. Damages to surfaces or equipment as a result of negligence shall be replaced or corrected as required.

B. School activities may be under way during much of the construction period. It is imperative that school functions and activities are given priority and the highest level of respect. Contractor functions which may be excessively noisy or disruptive shall be scheduled for times when school functions will not be interrupted or disturbed.

3.7 ENVIRONMENTAL AIR PLENUMS

A. In spaces over hung ceiling which are used for environmental air handling purposes as defined by Article 300.22C of the National Electric Code, power data and communications cable must be in conduit or of the type cable rated for air plenum use. Cable type and/or raceway is generally indicated on the drawings and specifications although the Contractor shall be responsible to clearly define ceiling space used for environmental air purposes.

3.8 SPECIAL ENGINEERING SERVICES

A. In the instance of complex or specialized telecommunications, security, and audiovisual systems that are included in Division 27; the installation, final connections, and testing of such

systems shall be made under the direct supervision of competent authorized service engineers who shall be in the employ of the respective equipment manufacturer. Provide the Owner with copies of instruction manuals and booklets for each system and piece of equipment installed. Provide any additional instruction to the Owner over and above the listed above in the care, adjustment, and operation of all parts of the communications systems.

END OF SECTION 28 05 00

SECTION 28 23 00

SECURITY CAMERA SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division I Specification Sections of the Contract, apply to this Section.

1.2 SUMMARY

A. This Section includes furnishing of equipment and installation of a CCTV. Contractor shall be responsible for installation and programming of any cameras to this system. Contractor is responsible for the supply and installation of any video input/output cards, switching bay boxes, or any other head end equipment required for a complete system and provide a fully operational CCTV system. The contractor shall provide all wiring, fiber and electrical power, to provide control of pan/tilt/zoom cameras and all CCTV equipment.

B. **Contractor shall provide the services of a qualified and certified security contractor as follows:**
Security contractor shall be LENEL certified

C. The supplier must complete a turn key installation. The supplier shall provide all necessary labor, tools, equipment and material required to furnish and install a complete and fully operational LENEL Onguard Access Control System.

D. The Supplier shall provide two LENEL NVR with 18TB of storage capable to support up to 75 cameras with room of expansion. The supplier shall install vandal resistant AXIS (P3363-VE/P3363-V) domes. Any cameras in the actual cell areas shall be installed in a corner mounted vandal resistant housing with an Arecont Box Camera (AV2115DNV1 2.1mp) Box Camera with Lens (MPL412 4.5-12mm lens). Any outdoor cameras that are not spec'd to be a PTZ (AXIS Q6035-E PTZ) shall be an Arecont 180 8mpx (AV8185DN) camera.

E. **LENEL Local Authorized Vendor:**
Homeland Security Ground, Inc, ***(410)825-3535 Office, Attn: Brooke Elsnic***
1713 East Joppa Road, Baltimore, Maryland

1.3 SUBMITTALS

A. Product Data: Include detailed manufacturer's specifications for each component specified. Include data sheets reflecting the model numbers, features, ratings, performance, power requirements, and dimensions.

B. Shop Drawings: For CCTV equipment to include plans, elevations, sections, details, and attachments to other Work.

1. Include dimensioned plan and elevation views of components and enclosures. Show access and workspace requirements. Shop drawings shall include mounting details for all wall and pole mounted equipment. Such details shall include all mounting brackets, hardware, and connections to the building and pole structures.

2. Wiring Diagrams: Power, signal, and control wiring point-to-point diagrams. Differentiate between manufacturer-installed and field-installed wiring.
3. It is the Contractors responsibility to submit for approval the complete designed system configuration and layout showing all devices, wiring, conduit, and locations along with other required information as specified herein for the completely integrated system proposed for installation.

C. Coordination Drawings: Plans drawn to scale and coordinating locations of CCTV equipment. Show the following:

1. Method of attaching hangers to building structure.
2. Location of items requiring installation coordination including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and other architectural features.

D. Samples: Provide full size samples of each outlet; finish plate, for colors and textures required.

E. Product Certificates: Signed by manufacturer of CCTV equipment and components certifying that products furnished to the Contractor comply with requirements.

F. Installer Certificates: Signed by manufacturer certifying that installers comply with manufacturers requirements.

G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements of installed systems.

H. Maintenance Data: Maintenance Data for CCTV equipment and components shall be a part of the maintenance manuals specified in Division 1. In addition to requirements specified, to be provided include the following:

1. Detailed operating instructions covering operation under both normal and abnormal conditions.
2. Routine maintenance requirements for system components.
3. Lists of spare parts and replacement components recommended are to be stored at the site for ready access.

I. Warranties: Special warranties specified in this Section.

J. Calculations and Parameters; Contractor shall submit for approval, the calculations used and plans and diagrams for the Field of View calculations for the CCTV system. Submission as a minimum shall include and address Low Level Lighting. Backlight compensation, and Lens conformance with this Specification.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: This project requires an experienced installer with a minimum of five (5) years experience installing CCTV equipment and possess manufacturers certification, for both installation and maintenance of equipment required for this Project.

B. Product Options: Drawings shall indicate size, profiles, and dimensional requirements of surveillance equipment and are based on the specific system indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division I Section "Substitutions."

C. Electrical Components: Devices, and Accessories; Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. Comply with 47 CFR 15, 17, and 76.

F. UL Compliance. Comply with applicable requirements of UL safety standards pertaining to television equipment and accessories. Provide TV equipment and accessories, which are UL-listed and labeled.

1.5 PROJECT COND1TIONS

A. Environmental Limitations: System components shall be equipped and rated for the environments where installed

1. Service Conditions for Outdoor Equipment: Rate equipment for continuous operation under the following environmental conditions, unless otherwise indicated:
   a. Temperature: Minus 15 deg F to plus 122 deg F.
   b. Relative Humidity: 5 to 100 percent.
   c. Weather: Enclosure housings to prevent entry of moisture due to melting ice build-up or driven rain or snow.

2. Service Conditions for Indoor Equipment: Rate equipment for continuous operation under the following environmental conditions, unless otherwise indicated:
   a. Temperature: 32 deg F to 140 deg F.
   b. Relative Humidity: 0 to 95 percent.

1.6 COORDINATION

A. Coordinate layout and installation of CCTV surveillance equipment and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.7 WARRANTY

A. Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1. Special Warranty for Surveillance System and Components: Written warranty, signed by manufacturer and Installer agreeing to correct system deficiencies and replace components that fail in materials or workmanship within specified warranty period when installed and used according to manufacturer's written instructions. This warranty shall be in addition to, and not limiting, other rights Owner may have under other provisions of the Contract Documents.
2. Special Warranty Period: Five years from date of Substantial Completion.
3. Technical Assistance: CCTV equipment manufacturer shall provide a 24-hour technical telephone assistance program, allowing for the communications directly with manufacture employees to answer any questions and resolve problems over the telephone on a 24-hour basis.
4. Repairs: Manufacturer shall provide 24-hour repair and turn around service on all CCTV equipment.

B. This section applies to security cameras accessories and equipment.

1.8 GENERAL REQUIREMENTS

A. Design, furnish and install the camera system equipment and layout in conformance with IES recommended procedures. All CCTV system components are to be new, unused products provided with complete Manufacturer's and Contractor's warranty of no less than five years Parts and Labor service. All of the equipment to be furnished is to interface and directly connect to the new headend LENEL CCTV equipment . Code converter boxes or translator equipment will not be acceptable.

B. Lighting: Contractor will assure that adequate area lighting exists to allow for the proper viewing of the video images in the viewing area. This may be accomplished by use of the appropriate combination of cameras, lenses, environmental enclosures, and mounts, as well as, the possible addition of exterior lights. Metal Halide is the preferred exterior lighting source.

1.9 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of each camera with the switching arrangements and provide the Owner with accurate As-built plans within 30 days of contract closeout.

1.10 REFERENCES

A. Building exterior shall be a mountable surface capable of bearing a shear weight of 100 lbs.

1.11 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

B. Security Contractor shall be LENEL Certified.

C. Security Contractor must have one hour response time.

D. Security Contractor shall be have experience minimum of 5 years of similar installations.

PART 2 - PRODUCTS

2.1 CAMERA EQUIPMENT AND ACCESSORIES

A. Network Video Server: Provide two 75 video input network video server with 18TB of internal storage. The network video recorder shall provide 90 retention of all camera images, at 16 to 20 frames per second, set to record on motion. Provide Software. NVR shall be LENEL NVR or approved LENEL equal, complete with all licenses.

B. Power Supply: Each power supply shall provide outputs for exterior camera power. Power supply shall be LENEL

C. Interior Fixed vandal resistant Cameras Each interior color camera shall be recessed and secured to the beam structure of the building or the Owner may opt for corner-mounted or wall-mounted units. All cameras that are recessed will be required to have the domes at ceiling level. It is the Contractor's responsibility to coordinate the camera type and lens requirements with the Owner before the purchase of the cameras as stated in submittals above. The Contractor shall refer to the Camera Schedule and Drawings for installation location and type. The cameras shall be AXIS IP (P3363-VE/P3363-V) domes, Pelco Sarix or approved LENEL equal. Any cameras in the actual cell areas shall be installed in a corner mounted vandal resistant housing with an Arecont Box Camera

(AV2115DNV1 2.1mp) Box Camera with Lens (MPL412 4.5-12mm lens)

D. Exterior Fixed Color Dome Cameras :Each exterior color camera shall be recessed and secured to the beam structure of the building or the Owner may opt for corner-mounted or wall-mounted units. It is the Contractor's responsibility to coordinate the camera type and lens requirements with the Owner before the purchase of the cameras as stated in submittals above. The Contractor shall refer to the Camera Schedule and Drawings for installation location and type. The cameras shall be LENEL PTZ (AXIS Q6035-E PTZ) shall be an Arecont 180 8mpx (AV8185DN) camera, Pelco Sarix or approved LENEL equal.

F. Mounts: An appropriate mounting device will be provided at all camera locations to provide a stable and accessible means of access to the camera site. The specifics of each site location will be determined by local considerations at the indicated mounting location during the site walk-through. When domes are mounted to on the roof of buildings, parapet mounts, which incorporate swinging arms for serviceability, shall be provided.
Provide LENEL wall mount SWM-GY for exterior camera with LENEL IE-P pendant adaptor

G. CCTV EQUIPMENT CABINET : Two door floor -mounted enclosed metal cabinet arranged to house standard mounting electronic equipment, 21 inches wide, steel shelf enclosure with 16-gauge ends and 18-gauge shelves, six pieces bolted together, with four mounting holes on 16-inch centers for mounting to wall studs. Weight capacity 150 pounds. Finish: Standard black powder coat. Provide fans, grounding bar, door locks, power distribution outlet strip, and all required accessories for a complete installation.

H. SOFTWARE: Provide LENEL CCTV software for remote viewing over the network. Provide LENEL Video recording software for archiving on the server. Provide failover directory server software and keyboard and monitor connection software as needed for a complete system.

I. MONITORS : Provide two LCD flat screen 42" security displays (LENEL) in Work Room. Provide tilt wall mount bracket (LENEL) . Provide one 19" LCD flat screen display (LENEL Series) in the equipment rack. Provide rack mount for display.

2.2 SPLICES, TAPS

A. All splices underground; in hand holes or other wet locations shall be waterproof and made with Scotch-cast 85 Multi-Mold Splicing Kits, or approved equal.

B. All taps shall use suitable connectors such as Burndy Type Ks and taped with two layers of 3M Scotch Brand or approved equal rubber tape and six layers of vinyl plastic electrical tape.

C. Splices in hand holes shall be supported on bricks 8 inches above the bottom of the hand hole. Splices shall be kept to a minimum.

2.3 VIDOE INTERCOM DOOR ENTRY SYSTEM

A. Furnish and install all equipment, accessories, and materials in accordance with these Specifications and drawings to provide a complete and operating integrated video intercom door entry system consisting of door entry station. Master control video entry stations, power supplies, wiring and other products as required for a complete system.

B. Provide Helios IP Force Video Entry Intercom System compatible & integrated with the Lenel Onguard software.

C. Provide integration to video camera recording system. Provide cable from video output of Video Door Entry System to the Security Camera Network Video Recorder.

2.4 ALARM SYSTEM

A. Furnish and install all equipment, accessories, and materials in accordance with these Specifications and drawings to provide a complete and operating integrated Security System consisting of security control panel, keypad command center, power supplies, alarm sirens, contacts, sensors, point of protection devices, wiring and other products as required for a complete system.

B. Provide a complete and ready intrusion detection security system. The system shall safeguard the perimeter and interior of the building against theft and vandalism. Equipment used shall be UL listed and the product of a manufacturer with established reputation and experience, who shall have produced similar equipment for a period of at least ten years.

C. All equipment such as control units, door contact sensors, key pads, etc., shall be furnished in the quantities called for, and located where indicated on the plans and drawings. The Intrusion Detection System, as herein specified and as located on the Drawings, had been designed around the Owner's preferred products, proposed substitute Intrusion Detection systems will be considered for review and approval during the submittal process.

D. Control/Communicator Panel shall be Digital Security Controls DSC PowerSeries 1864 Control Panel.

E. LCD keypad shall be DSC PK5500 keypad.

F. Door contact switches shall be wide gap, magnetic type, with all contacts hermetically sealed against dirt, moisture, etc. Units shall be recessed in doors and frame unless not possible. Provide armored leads. Where surface mounting is required, obtain approval for mounting and device type prior to work. Contacts shall be supervised for open circuits, wiring shorts, etc. Unit shall not be affected by normal temperature swings, vibration, shock, etc. Provide GE #2505A, or approved equal. Mount contacts on top of door, approximately 3 inches from the opening edge.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Examine adjacent surfaces to determine that surfaces are ready to receive work.

B. Examine each piece of equipment to determine suitability for location specified.

3.2 INSTALLATION

A. Install camera equipment and accessories in accordance with manufacturer's instructions.
   1. Install equipment in consoles and EIA Standard 19" Equipment Racks.
   2. Connect equipment to the branch circuits and cables provided by Contractor.
   3. Bond products and metal accessories to the branch circuit equipment-grounding conductor.

B. Equipment shall be located clear of equipment that will affect the field of view of the cameras. The Owner reserves the right to relocate any camera within 15 feet from locations shown on drawings at no cost to the Owner.

C. Open trenches shall not exceed 30 linear feet before backfilling. All trenching shall conform to National Safety Standards. Contractor shall be responsible for traffic control, backfilling, asphalt or concrete repairs to the roadway, driveways, or sidewalks. No trench shall be left open overnight. It is the contractor's responsibility to provide any steel plates to maintain traffic and vehicle access each day at job shutdowns. Contractor is also responsible for locating any utilities before trenching or digging begins.

3.3 ADJUSTING AND CLEANING

A. Adjust equipment as directed by the Owner.

B. Clean paint splatters, dirt, and debris from installed equipment.

C. Touch up enclosures, buildings, and interior finish at completion of work.

D. Replace equipment and mounts, which have failed at completion of work.

3.4 COORDINATION

A. Confirm compatibility and interface of other materials with CCTV system. Report discrepancies to the Owner.

B. Supply trim rings, back boxes, etc., to other trades as necessary.

C. Coordinate with the Mechanical, and Structural Contractors to avoid conflicts between cameras, supports, fittings, and mechanical equipment.

D. Before ordering, confirm construction details and architectural finish for each area with the Owner.

3.5 ACCEPTANCE

A. Contractor shall demonstrate to the satisfaction of the Owner that all equipment is operating properly. Any faulty equipment shall be replaced at the Contractor's expense. The Contractor shall demonstrate operation of all installed equipment.

END OF SECTION 282300

SECTION 28 31 11

FIRE DETECTION AND ALARM SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

A. Contractor shall provide and install a microprocessor based fire alarm and detection system. The system and components shall be the product of a single manufacturer of established reputation and experience. Installation shall include all parts, labor, software and hardware necessary to effect a complete installation.

B. In addition to the requirements of this section, the electrical and fire alarm contractors shall review the mechanical drawings for quantities and locations of fire alarm devices such as smoke detectors, heat detectors, smoke dampers, etc.

1.2 REQUIREMENTS

A. The latest editions of the following codes and standards shall govern work performed under this section:

1. Maryland State Fire Prevention Code (COMAR 29.06.01 and 29.06.02)
2. NFPA 101 - Life Safety Code
3. International Building Code (IBC)
4. International Fire Code (IFC)
5. NFPA 70 - National Electrical Code
6. NFPA 72 - National Fire Alarm Code
7. NFPA 80 - Fire Doors and Windows
8. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
9. Americans with Disabilities Act (ADA)
10. NFPA 720 – Installation of Carbon Monoxide (CO) Detection and Warning Equipment.

1.3 RELATED SECTIONS

A. Division-8 Section - Door Hardware: Door closers, electric locks, electric releases.

B. Division-21 Section - Fire Protection.

C. Division-23 Section - Ductwork Accessories: Smoke dampers.

D. Division-26 Section - Raceways.

E. Division-26 Section - Wires and Cables.

F. Division-26 Section – Boxes, Fittings and Cabinets.

1.4 SYSTEM DESCRIPTION

A. The fire detection and alarm system shall be a microprocessor based, power-limited, supervised, 24 VDC, non-coded system utilizing voice alarm notification. An event history log of up to 500 alarm and trouble events shall be continuously maintained in non-volatile memory at the control unit. (The actual number of individual alarm and trouble events may be less than 500, provided the total combined number of alarms and troubles logged is at least 500.) The system shall be capable of providing the following functions:

1. Integral clock/calendar.
2. Alarm verification (assigned by detector address).
3. System shall comply with National Standard Evacuation Signal Temporal Code 3.
4. Functional walk-test of all initiating and signaling devices.
5. User defined automatic voice evacuation message.
6. Public address at control unit and remote location.
7. Indicate all alarm and trouble events at a remote fire alarm annunciator (textual visual appliance) and record same using an printer.
8. HVAC monitoring and control.
9. Standby generator system monitoring and control.
10. Drill switch.
11. Activate sprinkler water gong mounted on exterior of building upon activation of sprinkler pressure switch (switch operates upon fluctuation of water pressure).

B. Initiating Devices:

1. Provide manual stations within five feet (1500 mm) of each exit along the normal path of egress travel, along the egress path as required to ensure that travel distance to any manual station does not exceed 200 feet (60 m), and where required by NFPA 72.
2. Provide analog smoke detectors outside each elevator door, inside each elevator machine room and elevator shaft, and at each door hold open device as required by NFPA 72.
3. Provide analog smoke detectors at the top and bottom of each elevator shaft when the elevator shaft is protected by a sprinkler system.
4. Provide analog duct smoke detectors, sampling tube, housing and mounting equipment and connect to system to initiate supervisory signal and shutdown respective air handlers as required by NFPA 90A.
5. Supply interface monitor modules for automatic sprinkler system waterflow switches and connect to the system to initiate alarm signal.
6. Supply interface monitor modules for automatic sprinkler system valve tamper switches and pressure switches and connect to system to initiate supervisory signal.
7. Provide heat detectors at the top and bottom of each elevator shaft when the elevator shaft is protected by a sprinkler system. Provide a heat detector within two feet (600 mm) of each sprinkler head.
8. Provide heat detectors in elevator machine rooms when the elevator machine room is protected by a sprinkler system. Provide a heat detector within two feet (600 mm) of each sprinkler head.

C. Notification Appliances:

1. Provide combination speaker/strobe, strobe and speaker signals throughout as required to ensure audibility and intelligibility of signal as detailed in NFPA 72.
2. Provide additional non-textual visual appliances throughout building to ensure all signals are visible to all occupants as required by the ADA.

D. Auxiliary Functions:

1. HVAC Shutdown - Shut down respective air handler upon activation of associated duct smoke detector(s).
2. Door Holders - Release doors automatically upon activation of associated smoke detector(s).
3. Elevator Recall - Control modules shall be installed in all elevator machine rooms. Elevators with recall capability shall be connected to the control modules to provide elevator recall. Elevators without recall capability shall not be connected, but control modules shall be installed for future use.
4. Elevator Disconnects - Heat detectors located in elevator machine rooms and at the top and bottom of elevator shafts shall be connected to automatically open the elevator disconnect(s).
5. Smoke Dampers - Close respective smoke damper upon activation of associated duct smoke detector(s).

E. Voice/Alarm: During normal system operation, activation of any alarm initiating device shall cause an attention signal to be broadcast over audible signals to be followed automatically by a custom voice message. The attention signal shall be three slow whoops (slowly ascending tone from 200 to 830 hz in 2.5 seconds) separated by one-half second intervals. The voice message shall begin with a female voice instructing occupants as follows: "Your attention please! Your attention please!" In all areas other than areas designated to have a special message, a male voice shall then direct occupants as follows: "A fire has been reported in the building. Please leave the building by the nearest exit or exit stair. Walk, do not run, to the nearest exit." The entire message shall be repeated twice. At the end of the message, the signals shall resound for one cycle then pause for ten seconds. At the end of the ten second interval, the tone/voice sequence shall begin again and continue until silenced at the fire alarm annunciator or system control unit. Evacuation tones shall be transmitted to zones not programmed for voice messages. The system shall have the capacity to transmit live voice messages from a microphone station located in the fire command center.

F. Public Address: During some events and emergencies it may be desirable to disable the voice alarm system and direct occupants over the fire alarm speakers. In the public address mode, the voice alarm signals will be used to transmit instructions. The public address function shall be capable of manually overriding all other signals and users in selectable zones. Activation of any alarm initiating device will automatically cause all visual appliances to flash continuously until the system is reset. Public address controls shall be provided at the fire alarm control panel and the fire alarm annunciators or as indicated on the drawings.

G. Off-Site Supervision: Alarm, supervisory and trouble conditions shall be automatically transmitted to a central station. Provide all relays, equipment and wiring necessary to connect the fire alarm and detection system to a central station. Individual signals shall be transmitted for alarm, supervisory and trouble conditions.

H. All fire alarm control equipment, devices and wiring shall be protected against unwanted radiated electromagnetic interference (EMI) and radio frequency interference (RFI) which can interfere with normal system processing and possibly cause unwanted alarms. The system shall be designed and installed to be unaffected by the operation of a handheld portable radio of 5 watts generating capability, or cellular telephone, within 12 inches of any system devices with appropriate covers installed.

1.5 QUALITY ASSURANCE

A. The system and all components shall be listed by Underwriters Laboratory for fire protective signaling service (local and remote station, emergency communication and relocation equipment, protective signaling systems) under UL 864. Automatic detectors, manual stations, sprinkler system alarm attachments, control unit accessories, indicating appliances and all other alarm system attachments shall be listed, labeled and approved for use with the specified control equipment. Visual indicating appliances shall be listed and labeled under UL 1971, "Signaling Devices for the Hearing Impaired".

1. Equipment Not Described: The Drawings and Specifications are schematic only and are not intended to relieve the Contractor from responsibility for furnishing all material, equipment and labor required to affect proper system operation. System subassemblies, software, programming, hardware, interface devices, controls, tools, test equipment and related devices vary considerably among manufacturers and cannot be fully described without reducing competition.
2. Manufacturer/Distributor Support: The Contractor shall confirm to the satisfaction of the Owner that a factory authorized support organization exists within close proximity to the site. Such organization shall be adequately stocked with equipment, parts and accessories, and adequately trained and capable to perform all required engineering, maintenance and testing support necessary to ensure continued efficient and effective system operation.

1.6 SUBMITTALS

A. Shop drawing and product data approval shall be obtained from the Engineer and Fire Marshall prior to commencing system installation. Submit shop drawings and product data as required for review and approval. Following substantial completion, operations and maintenance data and record drawings shall be submitted to the Owner.

1. Shop drawings shall include a building floor plan indicating the location of all zones, system devices and components, a wiring riser diagram, panel wiring diagram, device wiring details, listing of device addresses, sequence of operation and battery calculations. Drawings shall clearly indicate the height and location of all equipment, devices, wiring, conduit and junction boxes. Drawings shall be clean, neat, professionally prepared by CADD or manual drafting.
2. Statement of Compliance and Deviation:

    a. The submittal package shall include a copy of these specifications with each sub-paragraph noted with the comment "Compliance", "deviation", or "alternate".

b. By noting the term "compliance", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
c. By noting the term "deviation", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
d. By noting the term "alternate", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. Any alternate shall be fully described as to what the manufacturer proposes to provide.

3. Installation Instructions: Manufacturer's installation guide and programming instructions shall be submitted with the shop drawings.
4. Operations and Maintenance Data: Manufacturer's operating instruction and maintenance manuals, installation instructions and programming guides shall be supplied to Owner and his representatives within fifteen (15) days of substantial completion. Five (5) copies of each manual shall be provided.
5. Installer's UL Certificate: Provide a copy of the UL certificate or equivalent evidence that the fire alarm contractor is listed by UL or a NRTL for installation and maintenance of "Protective Signaling Systems."
6. Record Drawings: All deviations from the approved shop drawings require prior approval of the Engineer. Within fifteen (15) days of substantial completion, record drawings indicating the location and configuration of all equipment, devices, wiring, conduit and junction boxes shall be supplied to the owner. Five (5) copies of each drawing shall be provided. Drawings shall be clean, neat, professionally prepared by CADD or manual drafting.
7. Computer (CADD) files of electrical drawings will not be made available to the Contractor for any purposes.

B. Manufacturer Seismic Qualification Certification: Submit certification that Fire Detection and Alarm System, accessories, and components will withstand seismic forces defined in Division 26 Section “Seismic and Wind Controls for Electrical Systems and Equipment.” Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

a. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices and installation requirements on which the certification is based and their installation requirements.

1.7 SPARE PARTS

A. Contractor shall supply the Owner with a minimum of one (1) replacement for each six (6) devices (or fraction thereof) installed of the following devices:

1. Analog Smoke Detectors

2. Manual Stations
3. Interface Monitor Modules
4. Interface Control Modules
5. Speaker/Strobe Signals (voice system only)
6. Strobe Signals
7. Duct Smoke Detector
8. Door Hold Open Devices
9. Heat Detectors
10. Speakers (voice system only)
11. Amplifiers (voice system only)
12. Single and multiple station smoke alarm devices
13. Single and multiple station CO alarm devices

1.8 PROGRAMMING AND TEST DEVICES OR TOOLS

A. Contractor shall furnish all devices necessary to conduct tests of all devices and equipment prior to substantial completion. Upon satisfactory completion of required tests, the contractor shall furnish the owner with two of each device, tool or accessory used and required to perform complete periodic tests and maintenance. Such devices or tools may include interface devices, interface module programming tools, keys, program codes, software and the like. These devices, tools and accessories shall become the property of the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The fire alarm system shall be manufactured by Edwards I/0 500 (Basis of Design). No substitutions will be permitted.

2.2 CONTROL PANEL

A. The control panel shall provide power, supervision, annunciation and control of all detection and alarm devices. All external circuits shall be inherently power-limited as described in NFPA 70 Article 760. The control panel shall be of modular construction to permit expansion and modification of system functions. All modules and controls required to provide reliable operation as described in the Drawings and Specifications shall be provided. The status and sensitivity of analog devices shall be capable of being read, displayed and adjusted at the control panel. The system shall be capable of responding to alarm conditions while in the maintenance, program and test modes. Program or maintenance activities which bypass or disable system devices or functions shall be continuously monitored, displayed and recorded in the event history log. When devices or functions are disabled or bypassed, a trouble or supervisory condition shall exist until the function is restored to "normal". Addressable devices and addressable interface modules (monitor and control) shall be individually identified by the control unit. Conventional devices shall be capable of being supported by addressable interface modules.

B. Textual annunciation shall be provided at the control unit and remotely as indicated on the Drawings. The textual display shall consist of an 80 character alphanumeric display, which shall include a 32 character user defined message for each device or function. Each of the following functions shall be continuously monitored: analog detector sensitivity, response, open circuits, short-circuit faults, ground faults (+/-),

functionality and test. The annunciator shall be capable of displaying the status of each detector and occurrence of each state. All events displayed on the textual display shall also be recorded on an integral, 40-column, thermal strip printer. Annunciator controls at each location shall include momentary contact switches for locate, next alarm, next trouble, display hold, acknowledge, signal silence, trouble silence and system reset. Equivalent switch configurations providing the same functions are acceptable. LEDs shall be provided at each annunciation location to indicate system power (green), trouble (yellow), supervisory alarm (yellow), alarm (red). The connection between the remote annunciation and the system control panel shall be electrically supervised.

C. All wiring shall be continuously supervised for proper operation. There shall be no unsupervised wiring except for short connections, not to exceed 10 feet (3 m) in length, to motor starters and controls. Abnormal conditions shall be reported at the control unit and remote annunciator within 90 seconds of occurrence.

D. The removal or disabling of any initiating or notification appliance shall produce a trouble signal. Replacement of any analog initiating device with another device of another type, even with the same address, shall initiate a trouble signal.

E. Primary power shall consist of a two-wire 120 VAC branch circuit as indicated on the Drawings. The branch circuit disconnect shall be arranged and protected to prevent inadvertent disconnection and ensure optimum reliability.

F. Secondary supply batteries shall be capable of powering the system under maximum normal load for twenty-four (24) hours followed by fifteen (15) minutes of evacuation alarm operation at maximum connected load in accordance with NFPA 72 requirements for emergency voice/alarm communications service. In the alarm mode, the system shall be capable of powering all devices including public address or voice/alarm speakers, strobe lights, detectors and auxiliary devices. All circuit wiring (AC or DC) shall be separately fused within the control panel.

G. In the control mode, the system operator shall have the ability to arm or disarm system devices and control functions individually (by address) and manually operate devices. Analog detector sensitivity shall also be adjustable in the control mode. Access to the control mode shall be restricted by security passwords.

H. The system shall permit functional tests of all initiating and indicating appliances by a single individual remote from the control panel. The system shall maintain a log of this activity on a dedicated printer and retain a record in the event history log of the last 500 events. Provide a 24-pin “dot-matrix” printer. Provide portable stand for printer with paper storage space. Stand shall be approximately 3 feet high. Coordinate dimensions of stand with printer.

I. A drill switch shall be provided to operate the alarm indicating appliances without causing other control circuits to be activated. However, should a true alarm occur, all alarm functions would occur as described previously.

J. Activation of any alarm initiating device shall automatically operate all audible and visual appliances and produce an alarm signal at the control unit and at the remote annunciators. Subsequent alarm events shall be continuously stored in the event history log. Alarm signals shall have priority over all other system signals. All alarm signals shall be automatically transmitted to the central station.

K. Activation of an analog duct detector, sprinkler valve tamper switch, pressure switch, door hold-open smoke detector, standpipe flow switch, or fire pump alarm shall

initiate supervisory alarms at the system control panel and at the remote annunciators. Supervisory audible and visible alarms at these locations shall be distinct from either alarm or trouble conditions involving the same or related devices. All supervisory alarms shall be transmitted to the central station.

L. Open circuits, ground faults, missing detectors, abnormal detector status (e.g.: dirty detector, replacement incompatible with definition), disabled devices, low battery voltage and abnormal control functions shall initiate audible and visible trouble signals at the control unit and remote annunciators. Audible trouble signals shall sound until silenced. Silenced trouble signals shall be continuously indicated by a textual message and a trouble LED until restored to normal operation. The trouble LED shall remain illuminated until all abnormal conditions are cleared. Upon a return to normal operation the audible trouble signal shall resound until restored to normal position. Subsequent trouble events shall resound audible trouble signals until silenced. All trouble events shall automatically be transmitted to the central station.

M. Access to control unit and remote annunciator switches, wiring and power supplies shall be restricted by keyed-alike locks. Control function and programming access shall be limited by user defined passwords.

N. One-Way Voice Communication: A central audio control module shall be provided for the necessary alarm message/tone generation, and main and remote microphone connections. Continuous supervision shall be provided. A hand-held push-to-talk microphone shall be provided at the control panel and each remote panel. The microphone shall be a dynamic communication type with a frequency range of 200 Hz to 4000 Hz and shall be equipped with a self-winding five foot (1500 mm) coiled cable. An LED indicator shall be provided to indicate microphone push-to-talk button has been pressed and speaker circuits are ready for transmission. Microphone shall be supervised from disconnection. An audio control switch module shall be furnished to provide manual control of audio functions for any single zone or any combination of multiple zones. These switches and associated LED indicators shall be supervised from disarrangement or failure. Audio power amplifiers shall be furnished with self-contained filtered 24VDC power supply, transformer and, amplifier monitor circuits. Amplifiers shall provide an output with a frequency response of 120 Hz to 12,000 Hz. Provide a sufficient quantity of amplifiers to operate all system speakers at their highest tap settings simultaneously plus ten percent spare capacity.

O. Additionally, provide one spare connected amplifier that will be automatically switched in to the speaker circuit upon failure of either of the primary amplifiers. The remote fire alarm control panel shall include, but not be limited to, voice/alarm communication system amplifiers, microphone, zone selector switches, primary and back-up power supplies, control panel, processing unit and display.

2.3 ALARM INITIATING DEVICES

A. Alarm initiating devices shall consist of addressable detectors and manual stations. These devices shall be listed and approved for use with the control equipment specified.

1. Analog smoke detectors shall be addressable, ionization (or photoelectric where indicated on the Drawings), plug-in type with base. The detector base shall be of the twist/lock type with screw terminals for field wiring. An automatic gain control circuit shall be provided to compensate for detector aging and dirt accumulation and maintain the detector within the correct sensitivity range. A critical reduction of sensitivity caused by dirt

accumulation shall initiate a trouble signal. Detector sensitivity shall be capable of being read and adjusted from the control panel.

2. Interface monitor modules shall be addressable, mounted in standard 4" x 4" (100 mm x 100 mm) square or octagonal electrical boxes with covers. Cover shall be labeled or embossed with fire alarm system interface module designation. A solid state LED indicator lamp shall be visible in the cover. These modules are to be used for connection of conventional alarm devices such as waterflow switches, valve tamper switches, sprinkler pressure switch, fire pump alarms and other non-addressable devices. Connections between devices and modules shall be integrally supervised for open and ground faults. Monitor and control functions may be integrated in a single interface module if listed and approved for this purpose.
3. Duct type detector assemblies shall consist of an addressable analog photoelectric detector, an air duct sampling tube and detector housing. Provide a remote test station with alarm indicating lamp for all duct detectors installed in concealed spaces. Provide reset and test stations at readily accessible locations for all duct type detector locations.
4. Manual stations shall be addressable, red in color, non-coded, double-action, non-break glass type. Manual station covers shall be hinged and secured with a lockset. Lockset shall be keyed the same as the control unit lockset. Provide Pull Station cover with local piezo audible device manufactured by STI for all pull stations. Coordinate with County personnel.
5. Heat detectors shall be addressable, plug-in type with base. The detector base shall be of the twist lock type with screw terminals for field wiring. Detectors shall be rate-compensation, fixed temperature type, rated at 135 °F (57°C). Detector element shall be self-restoring after operation.

2.4 NOTIFICATION APPLIANCES

A. Alarm indicating appliances for areas where voice alarm is required shall consist of audible and visual signals for public signaling of fire. The primary signaling scheme shall consist of speaker/strobes transmitting a tone followed by a prerecorded custom message. In the public address mode, voice/alarm signaling functions will be overridden to transmit the public address message.

1. Speaker/strobes shall have semi-flush mounted with red covers and clear strobe lens. Speaker/strobe signals shall comply with the requirements of the ADA and NFPA 72, Chapter 6.
2. Strobe units shall consist of a red cover and clear lens. Strobe signals shall comply with the requirements of the ADA and NFPA, Chapter 6.

B. Strobes shall provide a minimum effective intensity of candela levels listed on the contract drawings. Strobes in hotel guest rooms and similar occupancies shall provide a minimum effective intensity of 110 candela. Strobes shall be listed to 1971 Standard Underwriter Laboratories.

C. Alarm indicating appliances to be installed on the exterior of the building shall be weatherproof and listed for outdoor use.

D. Contractor shall include 20 audible, 20 visual and 20 combination audible/visual devices inclusive of associated labor and material to install after final walk-thru by Fire Marshal. Devices shall be installed in locations as directed by Fire Marshal and shall include all cutting, patching and finishing of walls. All unused devices shall be turned over to the owner for use as spares.

E. Notification appliance circuits shall be designed for at least 20% spare capacity to add future devices.

2.5 AUXILIARY DEVICES

A. Magnetic door holders shall be used to hold fire or smoke doors in the open position during normal operation. Upon activation of smoke detectors located immediately adjacent to the door opening, the door holders release, allowing the doors to close automatically. Detectors initiating this function shall be located and installed in accordance with NFPA 80. Door holders shall be listed and approved for the intended use, and connected to the control panel by an addressable interface module (control).

B. Interface control modules shall be addressable, mounted in standard 4" x 4" (100 mm x 100 mm) square or octagonal electrical boxes with covers. Cover shall be labeled or embossed with fire alarm system interface module designation. A solid state LED indicator lamp shall be visible in the cover. These modules are used for control of auxiliary functions such as elevator recall, fan shutdown, sprinkler system electric water gong, and door holder release. Interface modules shall be equipped with form "C" dry-contacts rated 2A, 125 VAC or 2A, 30 VDC resistive. Monitor and control functions may be integrated in a single interface module if listed and approved for this purpose.

2.6 GRAPHIC ANNUNCIATOR PANELS

A. Provide active alphanumeric annunciator with key pad in main lobby.

B. Provide active graphic annunciator in main lobby.

C. Active graphic annunciator panels shall be minimum 24" x 30" (600 mm x 750 mm), with white photo-emulsion graphics in smoked plexiglass and LCD display. The panel shall include an outline of each zone and shall utilize backlit displays to indicate alarm types and locations.

D. The fire alarm control panel and annunciator panels shall include, but in no way be limited to, the following alarms, controls and status indicators:

1. Alarm, trouble and power-on for system.
2. Alarm type and location for each zone.
3. Trouble for each zone.
4. Run and trouble indicators for standby generator.
5. On indicators for major building HVAC equipment including AHU-1 and AHU-2 whether activated automatically or manually.

E. The graphic annunciator panel configuration shall be coordinated with the local Fire Marshal and submitted for approval before being manufactured or installed.

2.7 SINGLE AND MULTIPLE STATION CO ALARMS

A. Provide single and multiple-station CO alarm devices in locations as shown on the Drawings. CO alarm devices shall be manufactured by Gentex (model number CO1209F) or approved equal. CO alarm devices shown on the Drawings indicate areas where CO alarm devices shall be installed. The location and quantity of CO

alarm devices shall be in accordance with NFPA 720 and the specific listing of the device. All CO alarm devices shall be by the same manufacturer.

2.8 SINGLE AND MULTIPLE STATION SMOKE ALARMS

A. Provide single and multiple-station smoke alarm devices in locations as shown on the Drawings. Smoke alarm devices shall be manufactured by Gentex (model number S1209F) or approved equal. Smoke alarm devices shown on the Drawings indicate areas where smoke alarm devices shall be installed. The location and quantity of smoke alarm devices shall be in accordance with NFPA 72 and the specific listing of the device. All smoke alarm devices shall be by the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division-26 Section, Basic Electrical Materials and Methods for general execution requirements.

B. Smoke detectors shown on the Drawings indicate areas where smoke detectors shall be installed. The location and quantity of smoke detectors shall be in accordance with NFPA 72 and the UL Listing for the specific devices.

C. Heat detectors shown on the Drawings indicate areas where heat detectors shall be installed. The location and quantity of heat detectors shall be in accordance with NFPA 72 and the UL Listing for the specific devices.

D. Duct smoke detectors shall be installed in accordance with manufacturer's written instructions. Detectors shall be readily accessible for cleaning and testing. Provide access panels or doors if necessary. Provide duct detectors on both the supply and return of all air handling units provided under this contract unless otherwise noted.

E. Interface modules (monitor and control) shall be located within 3 feet (75 mm) of the device it is monitoring or controlling.

F. Strobes shall be installed with the bottom of the appliance 80 inches (2000 mm) above the finished floor or 6 inches (150 mm) below the finished ceiling, whichever is lower.

G. Manual stations shall be installed with the top of the device 48 inches (1200 mm) above the finished floor.

H. Coordinate connection of smoke dampers with mechanical contractor. Make special efforts to communicate and review fire alarm system voltage (24V) with mechanical contractor for smoke damper voltage.

I. Coordinate connection to 24 volt sprinkler system electric motor gong with sprinkler system contractor to ensure gong is only operated upon sprinkler pressure switch sensing a fluctuation in water pressure. Sprinkler electric water gong shall be powered from the fire alarm system by a fully supervised circuit. Provide power supervisory relay and monitoring module as required to provide this supervision.

J. Provide 2 analog Cat6 circuits from main FACP to the main voice/data closet.

K. The contractor shall provide Baltimore County with a notification list of at least two personnel, with phone numbers, who would be notified for immediate response for service requirements in the event of a false alarm or system malfunction. This notification list will be put in place during the period of time that the system has not been fully accepted by Baltimore County but is a monitored and functioning system, until the facility is turned over to Baltimore County.

L. Fire Detection and Alarm System shall be installed in accordance with manufacturer's recommendations and in accordance with project seismic requirements. Refer to Division 26 Section "Seismic and Wind Controls for Electrical Systems and Equipment' for additional information.

3.2 QUALIFICATIONS

A. System installation shall be supervised by an experienced fire alarm technician with not less than five (5) years experience with fire alarm systems. All field installation work shall be continuously supervised by a NICET Level II or III fire alarm system technician.

B. Fire alarm system shall be installed and maintained by a listed fire alarm contractor, listed by UL for installation and maintenance of "Protective Signaling Systems" or other NRTL. The fire alarm contractor shall meet all UL requirements and provide a copy of the UL certificate to the Fire Marshal.

3.3 CHANGES

A. The technician supervising field work shall promptly notify the engineer of any changes or deviations from the contract drawings and specifications necessitated by field conditions.

3.4 WIRING

A. All field wiring shall be installed in conduit. Conduit and boxes shall be sized according to National Electrical Code requirements based on the number of conductors. Initiating device circuit wiring shall be two-conductor twisted with integral shield and ground. Indicating appliance circuits shall be minimum 14 AWG. Primary power (AC) branch circuit conductors shall be minimum 12 AWG. Address loop circuits shall be a minimum of 18 AWG.

B. Fire alarm circuits shall be identified by red junction box covers stenciled in white letters "FIRE ALARM."

C. Fire alarm wiring shall be color coded in accordance with requirements of local Authority Having Jurisdiction.

D. The addressable loop shall be wired Class B, Style 4. The initiating devices shall be wired Class B, Style B. The notification appliances shall be wired Class B, Style Y. Where transponder panels are required, wiring from control panel through the transponder panels shall be Class A, Style 6.

E. All wiring shall be tested for the following conditions before devices are installed or circuits connected to control equipment:

1. Verify that stray (unwanted) voltages do not exist between the installation conductors and ground or between conductors.
2. Verify all conductors not intentionally grounded are isolated from ground using an approved insulation testing device or "megger."
3. Verify that all conductors not intentionally connected together are isolated from one another using an approved insulation testing device or "megger."
4. Measure and record the loop resistance of each circuit with the conductor pair shorted together at the far end, verify that loop resistance does not exceed manufacturer's requirements.

F. Supply the Owner and Engineer with a copy of all circuit testing reports and loop resistance readings.

3.5 SYSTEM TESTING

A. All initiating and indicating appliances, control equipment, accessories and auxiliary functions shall be tested in accordance with NFPA 72 acceptance test procedures. Representatives of the Owner, Engineer and local Fire Marshal shall be notified of the date and time of the test. A minimum of fourteen (14) days notice is required when scheduling the acceptance test. The Contractor is responsible for conducting all required tests. All necessary equipment and supplies shall be provided at Contractor's expense, including ladders, radios, test equipment, volt-ohm meter, sound-pressure (decibel) meter, flashlights, hand tools and smoke or smoke substitute for functional tests. All test procedures shall conform to the manufacturer's recommended test procedures and the NFPA 72 recommended practice. Subcontractors responsible for related work connected to or controlled by the fire detection and alarm system shall be available to demonstrate their equipment at the time of acceptance testing.

B. Testing of indicating appliances shall be scheduled in accordance with Owner requirements.

3.6 TEST REPORT

A. The Contractor shall prepare and submit a test report in the form and content required by NFPA 72. The report shall be signed by the supervising technician or fire protection engineer. The Contractor shall submit the report to the Owner and his representatives, upon completion of testing.

3.7 WARRANTY

A. The completed system including but not limited to all system component devices and associated peripheral devices shall be warranted for a period of two (2) years from the date of acceptance. The warranty shall cover all defects in parts and workmanship, and expenses related to parts, labor and travel to and from the site for the purposes of correcting same. Maintenance and repair shall be performed only by a factory trained service technician. More than two sparious alarms during the system warranty shall be unacceptable.

B. In addition to other specified requirements, the contractor shall provide two complete Fire alarm inspections during the warranty period. During the Warranty period, the contractor shall perform all required inspections, testing and maintenance for the entire system, in accordance with NFPA 72. The warranty period shall include annual

inspection and system calibration. The contractor shall warranty all materials and workmanship during the installation period and for the complete designated warranty period. This warranty shall cover all defects in parts and workmanship, and expenses related to parts, labor and travel to and from the site for the purposes of correcting same. This warranty shall include needed software updates or changes which will be performed by a certified manufacturer's representative. During the warranty period, at least one total system reprogramming shall be included by the contractor in his contract after system acceptance. The contractor shall be responsible during the installation, testing and warranty periods for any damage caused by him or his contractors or by defects in his or his subcontractor's work, materials, or equipment. Technical support, beginning with system acceptance, shall be provided during the warranty period at no cost to Baltimore County.

3.8 TRAINING

A. Contractor shall arrange and furnish training for Owner's representatives. This training shall include instruction in proper system maintenance, test and troubleshooting procedures. Provide a minimum of eight (8) hours of training.

END OF SECTION 28 31 11

SECTION 28 40 00

ACCESS CONTROL AND ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The supplier shall provide all necessary labor, tools, equipment and materials required to furnish and install a complete and fully operational Lenel Card Access System. The supplier shall have a minimum of five (5) years experience in the design, installation, and engineering of access control/alarm monitoring systems.

B. Provide new Lenel Card Access Control System using the latest Lenel Onguard software or version as directed by Baltimore County.. Provide all material, products, programming and services for a complete and operational system. Contractor shall provide all mounting hardware and door-frame preparation as required.

C. Provide Aiphone Video Entry and Door Intercom System.

D. Contractor shall provide the services of the current Baltimore county Government access control system vendor.

Provide the services of Easter Security Solutions. Contact:

Homeland Security Ground, Inc, ***(410)825-3535 Office, Attn: Brooke Elsnic***
1713 East Joppa Road, Baltimore, Maryland

1.2 CONTRACT REQUIREMENTS

A. The supplier shall provide and install a new Lenel Access Control System in the Building, in accordance with the Plans and Specifications. The System shall be modular in design with the ability to expand or migrate to a larger multi-user, multi-tasking system without replacing existing intelligent application nodes, card readers, cards, input devices or output devices. The system shall be capable of being upgraded without losing the existing database.

B. Provide and install Lenel LNL-2000 intelligent system controllers, Lenel LNL-1320 Dual Reader Interface Boards, Alarm-Saf AS/PS5BFS-12-UL 12 VDC power supplies with battery backup, and Lenel LNL-ETHLAN Ethernet protocol converters as required. The panel power supply shall have a LifeSafety-NL4 Power Module to monitor the power status of the panels.

C. Provide and install Lenel LNL-ETHAN Ethernet protocol converters for connection to the existing computer workstation.

D. The Contractor shall be responsible for extending the network wiring to the computer workstations.

E. Provide and install all peripheral devices shown, and system programming to form a fully functional operating system.

F. Submit Manufacturer's data on Card Access System equipment including, but not limited to, manufacturer's product data sheets for all system components and their quantities. Also include standard of typical riser and wiring diagrams, as well as floor plans showing device locations and the wiring thereof.

1.3 SYSTEM OPERATION

A. Valid Access: Requires presentation of card-to-card reader so that valid card holders, who are authorized for entry at a specific door at a specific time shall be granted access.

B. Valid Exit: Request to exit pushbutton or motion detector shall bypass door alarm and unlock door to allow egress.

C. Alarm Conditions:
   1. Alarm conditions will occur in the following circumstances:
      a. Door is held or propped open.
      b. Door is forced open, without using proper access card.
      c. Invalid card holder attempts access.
   2. All system events shall be recorded in system history buffer.
   3. Alarm conditions shall activate the building general partition of the intrusion detection system. Provide interface with Digital Alarm Communicator Transmitter for off-site monitoring.

PART 2 - PRODUCTS

2.1 ACCESS CONTROL SYSTEM COMPONENTS

A. The following equipment shall be approved for use on this project. The equipment shall be provided by the Manufacturer's "Factory Authorized Representative". Special systems suppliers or representatives that are not authorized by the Manufacturer to represent their product shall not be allowed to provide this equipment. No exceptions.
   1. Intelligent System Controller

      Lenel Systems International Model Number LNL-2000
      Intelligent System Controller (ISC) shall serve as the predominant access control engine. The ISC shall provide power, performance, and flexibility for the most demanding applications. Multiple combinations of Alarm Input Control Modules, Output Control Modules, and Card Reader Interface Modules shall be configured.

      The ISC shall communicate upstream at 115.2 Kbps via RS-232, RS-485 multi-dropped configurations, modem dial-up communications, or Ethernet TCP/IP Networks. The ISC shall store 350,000 cardholders. The ISC shall provide four downstream 2-wire RS-485 channels or two 4-wires-RS485 channels. In either configuration, the ISC shall allow connection of up to 64 readers or 32 devices on a single Intelligent System Controller.

      Required Features and Functionality:
      * Host Communications – 115.2 Kbps direct wire (RS-232/485), Ethernet TCP/IP or Dial-up Communications.
      * 12VAC or 12VDC input power.
      * Supports up to 8 different card formats and 8 asset formats.
      * Issue Code support for both Wiegand and Magnetic formats.
      * Enhanced anti-passback capabilities.
      * Flash memory for real time program updates.
      * Lithium battery back-up.
      * Holidays with grouping.
      * Time zones with 6 time intervals.
      * 1 MB onboard memory expandable to 8 MB (350,000 cardholders – 1 million events).
      * Up to 64 readers or 32 downstream devices.

* Alarm masking.
* Individual shunt (ADA required).
* Up to 9 digit pin codes.
* Downstream Serial RS-232 device support.

2. Dual Reader Interface Module
Lenel Systems International Model Number LNL-1320

Device shall accommodate two (2) access control card readers, keypad, or reader with keypad that uses standard data1/data0 and clock/data Wigand communications supported. Lock/unlock and facility code, off-line access modes shall be supported on reader connected to the SRI. Each SRI shall support up to 8 different card formats as well as issue codes for both magnetic and Wiegand card formats.

The SRI shall provide a vital link between the Intelligent System Controller (ISC) and the card reader attached to the interface. As many as 32 SRI modules shall be multi-droppable using RS-485 2-wire communication up to 16,000 feet (4,000 per port) away from the ISC. Each SRI module shall be individually addressed for increased reporting capabilities with Access Control software applications. The SRI shall include two (2) programmable inputs that support normally open, normally closed, supervised, and non-supervised circuits and two (2) output relays that support fail-safe or fail-secure operation.

Required Features and Functionality:
* VDC power supply.
* Multiple Wiegand Communications (Clock/Data or Dat1/Data0).
* Two (2) Form-C relay outputs (5A and 1A relays).
* Two (2) programmable inputs (supervised or non-supervised).
* Up to eight (8) different card formats.
* Issue Code support for magnetic and Wiegand formats.
* Door contact supervision (open/closed).
* REX push-button monitor.
* Strike control output.
* Bi-color status LED support.
* Beeper control.
* Plastic mounting channel.

3. Card Reader: Card Reader shall be magnetic stripe type, manufactured by Lenel LNC 2010.

4. Lock Power Supply(ies): Lock power supply shall be manufactured by Alarm-Saf, Model AS/PS5-BFS-12-UL with battery standby. Coordinate voltage requirements with door hardware provided by Architectural Hardware Contractor. Provide quantity as required.

5. Door Contact: Magnetic door contacts shall be concealed mount, as manufactured by Sentrol, Model 1076-W. Where surface mount is required, provide Sentrol Model 2507A. Provide and install one (1) at each card access door.

6. Electric Door Strike – 12 VDC Operation: Electric door strikes shall be provided and installed by the door hardware contractor and wired by the electrical contractor. This strike shall be 12VDC, fail-secure and selected to match door. All strikes shall be wired by the electrical contractor.

7. Access Control Hardware: Refer to and coordinate with architectural hardware schedule/Contractor to provide a complete operating system.

2.2 VIDEO ENTRY AND DOOR INTERCOM SYSTEM COMPONENTS

A. The following equipment shall be approved for use on this project. The equipment shall be provided by the Manufacturer's "Factory Authorized Representative". Special systems suppliers or representatives that are not authorized by the Manufacturer to represent their product shall not be allowed to provide this equipment. No exceptions.

2.3 DOOR ALARM SYSTEM COMPONENTS

A. Provide a complete stand-alone door alarm system to sound a local siren when a secure corridor door is open provide a local key switch to by-pass alarm on secure side of door.

B. Door alarm system shall include siren, recessed door contact, power supply, key switch and all products required for a complete and operational system.

C. Provide Door Alarm System at the following locations:
1. Door between Public Corridor
2. Door between Public Corridor
3. Door between Public Corridor

PART 3 - EXECUTION

3.1 INSTALLATION

A. System equipment and panels shall be mounted with sufficient clearance for observation and testing. All junction boxes must be clearly marked for easy identification. All wiring shall be in electrical raceways inside walls and partitions, above non-accessible ceilings or through rooms and areas without ceilings. All electrical raceways, mounting boxes, junction boxes and panels shall be securely hung and fastened with appropriate fittings to insure positive grounding throughout the entire system.

B. System cable shall meet the requirements for a plenum ceiling. It shall be installed above suspended ceiling at the roof deck level in a neat and workmanlike manner using bridle rings.

C. Wiring splices are to be avoided to the extent possible, and if needed, they must be made only in junction boxes. All conductors in raceways containing more than one wire shall be labeled on each end with "E-Z Markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be number-coded.

D. All wiring shall be checked and tested by the Contractor to insure that there are no grounds, opens, or shorts before power is applied to the system.

E. Final connections to the control equipment shall be made by the representative of the Manufacturer and connections to the remote devices shall be made by the Contractor.

F. Customization of the control equipment to meet the requirements of these specifications shall be as authorized by the Manufacturer and shall be included herein, one time, at the time of final acceptance and no customization shall void the UL listing.

G. System shall be installed in accordance with the plans and specifications. All applicable Codes shall be met, with particular attention to the National Electric Code (NFPA 70).

3.2 FINAL TESTS, TRAINING AND WARRANTY

A. Inspect relays and signals for malfunction, and where necessary adjust units for proper operation to fulfill project requirements.

B. Final adjustment, equipment start-up and operation and maintenance instructions shall be performed by specially trained personnel in direct employ of Manufacturer's representative.

C. Complete, accurate, step-by-step testing instructions giving recommended and required testing frequency of all equipment, shall be delivered to the Owner upon completion of the system.

D. Maintenance instructions shall be complete, easy to read, understandable, and shall provide a complete list of all equipment and components with information as to the address and phone number of both the Manufacturer and local supplier of each item.

E. Operation and Maintenance instruction period shall be four (4) hours, provided after acceptance of the System by the Owner.

F. The Contractor shall provide a one-year warranty of the installed system against defects in material and workmanship. All labor and materials shall be provided at no expense to the Owner during normal working hours. The warranty period shall begin on the date of acceptance by the Owner/Engineer.

END OF SECTION 28 40 00

SECTION 28 52 00

GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this Section.

1.2 SUMMARY

A. Provide all materials and labor for the installation of a grounding and bonding system for communications infrastructure. This section includes requirements for providing a permanent grounding and bonding infrastructure for communications circuits, raceways, and cable tray.

B. Related Sections

1. Division 27 Section — "Conduit and Backboxes for Communications Systems"

1.3 REFERENCES

A. The applicable portions of the following specifications, standards, codes and regulations shall be incorporated by reference into these specifications.

1. General:

a. National Electrical Code (NEC)

b. National Electrical Safety Code (NESC)

c. Occupational Safety and Health Act (OSHA)

2. Communications:

a. TIA/EIA - 568: *Commercial Building Telecommunications Cabling Standard*

b. TIA/EIA - 569: *Commercial Building Standard for Telecommunication Pathways and Spaces*

c. TIA/EIA - 606: *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*

d. TIA/EIA - 607: *Commercial Building Grounding and Bonding Requirements for Telecommunications*

e. ISO/IEC IS 11801: *Generic Cabling for Customer Premises*

f. BICSI: *BICSI Telecommunications Cabling Installation Manual*

g. BICSI: *BICSI Telecommunications Distribution Methods Manual (TDMM)*

h. BICSI: *BICSI Customer-Owned Outside Plant Design Manual (CO-OSP)*

1.4 DEFINITIONS

A. "TMGB" shall mean *Telecommunications Main Grounding Busbar.* There is typically one TMGB per building, located in the main telecommunications room. This busbar is directly bonded to the electrical service ground.

B. "TGB" shall mean *Telecommunications Grounding Busbar.* There is typically one TGB per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems.

C. "TBB" shall mean *Telecommunications Bonding Backbone.* The TBB is a conductor used to connect TMGBs to TGBs.

1.5 SYSTEM DESCRIPTION

A. Furnish, install, and place into satisfactory and successful operation all materials, devices, and necessary appurtenances to provide a complete, permanent Grounding and Bonding infrastructure for communications circuits, raceways, and cable trays as hereinafter specified and/or shown on the Contract Documents. The Grounding and Bonding system shall support an ANSI/TIA/EIA and ISO/IEC compliant communications Structured Cabling System (SCS).

B. The work shall include materials, equipment and apparatus not specifically mentioned herein or noted on the plans but which are necessary to make a complete working ANSI/TIA/EIA and ISO/IEC compliant Grounding and Bonding system.

1.6 SUBMITTAL INFORMATION

A. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.

1. Submit a letter stating that the materials will be provided as specified, and specifically listing any items that will not be provided as specified. The letter shall also state that the Contractor has reviewed the specified items and agrees that they are applicable to this project in all respects.

2. For those items noted as allowing "or equal," and which are not being provided as specifically named, submit standard manufacturer's cut sheets or other descriptive information, along with a written description detailing the reason for the substitution.

3. Provide standard manufacturer's cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

B. Closeout Submittals: Provide submittal information for review as follows:

1. O&M Manual for Communications - At the completion of the project, submit O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to the Designer in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description.

2. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of redline markups of drawings, specifications and spreadsheets.

a. Document changes to the system from that originally shown on the Contract Documents and clearly identify system component labels and identifiers on Record Drawings.

b. Keep Record Drawings at the job site and make available to the Owner and Designer at any time.

c. Keep Record Drawings current throughout the course of construction. ("Current" is defined as not more than one week behind actual construction).

d. Show identifiers for major infrastructure components on Record Drawings.

1.7 SEQUENCING

1.8 CONTRACTOR WARRANTY:

A. Provide a Contractor-endorsed two-year service warranty against defects in materials and workmanship.

1. Provide labor attributable to the fulfillment of this warranty at no cost to the Owner.

2. The Contractor Warranty period shall commence upon Owner acceptance of the work.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall consist of busbars, supports, bonding conductors and other incidentals and accessories as required.

2.2 MATERIALS

A. Grounding/Bonding:

1. Telecommunications Main Grounding Bus Bar (TMGB):

a. Large (20" x 4" x ¼"), Pre-drilled: CPI 10622-020, or equal

b. Small (10" x 4" x ¼"), Pre-drilled: CPI 10622-010, or equal

2. Telecommunications Grounding Bus Bar (TGB):

a. Large (20" x 4" x ¼"), Pre-drilled: CPI 10622-020, or equal

b. Small (10" x 4" x ¼"), Pre-drilled: CPI 10622-010, or equal

3. Telecommunications Bonding Backbone: #6 AWG insulated (green in color) copper conductor.

4. Grounding Conductor: #6 AWG insulated (green in color) copper conductor.

B. Firestopping Material: Conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions.

C. Labels: As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.

1. Hand-carried label maker:

a. Brady: ID Pro Plus (or approved equal).

2. Labels:

a. Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 -- REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

E. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

F. Install the grounding and bonding system in a manner ensuring that communications circuits, when installed, are able to fully comply with the ANSI/TIA/EIA and other references listed in Part 1 — References, above.

G. Remove surplus material and debris from the job site and dispose of legally.

3.2 INSTALLATION

A. The grounding and bonding infrastructure system shall not make use of the building plumbing system, unless required to do so by the NEC.

1. Coordinate the installation of the grounding and bonding system with the electrical power distribution system grounding infrastructure.

B. Ground/Bonding:

1. TMGB: Provide a minimum of one TMGB per telecommunications entrance room for each building and as shown on the Contract Documents. Install TMGB(s) and directly bond TMGB(s) to electrical service ground and to associated TBB(s). Group protector,

busbar bonding, and approved building grounding conductors toward one end of the TMGB and leave space for equipment grounding conductors on the other end.

2. TGB: Provide a minimum of one TGB per telecommunications room for each building and as shown on the Contract Documents and as required by the standards, references and codes listed in PART 1 -- REFERENCES above. Directly bond each TGB to its associated TBB and to the nearest building structural steel or other permanent metallic system. Group protector, busbar bonding, and approved building grounding conductors toward one end and leave space for equipment grounding conductors on the opposite end.

3. TBB(s) and Grounding Conductors: Provide TBB(s) and grounding conductors as shown on the Contract Documents and as required to bond all non-current carrying metal telecommunications equipment and materials to the nearest TGB. Use TBB(s) to connect the TMGB to each TGB. Route along the shortest and straightest path possible with minimal bends. Bends shall be sweeping. Insulate TBB(s) and conductors from their support. TBB(s) and grounding conductors shall be continuous (without splices).

   a. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic hardware.

C. Firestopping

1. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.

2. Maintain the fire rating of all penetrated fire barriers. Fire stop and seal all penetrations made during construction.

   a. Provide firestopping material for through and membrane penetrations of fire-rated barriers.

   b. Install firestops in strict accordance with manufacturer's detailed installation procedures.

   c. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer's recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply of sealing material in a manner acceptable to the local fire and building authorities.

   d. For demolition work, apply firestopping to open penetrations in fire rated barriers where cable is removed. Apply firestopping regardless of whether or not the penetrations are used for new cable or left empty after construction is complete.

   e. Firestopping material used to seal open penetrations through which cable passes shall be re-usable/re-enterable.

D. Labels:

1. Label TMGB(s) with "TMGB"

2. Label TGB(s) with "TGB".

3. Label TBB(s) and bonding conductors "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

END OF SECTION 28 52 00

SECTION 28 58 00

CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide all materials and labor for the installation of a pathway system for inside plant communications circuits. This section includes requirements for horizontal and building backbone raceways, fittings, and boxes specific to communications circuits (cabling) for voice and data.

B. Related Sections:

1. Division 27 Section — "Grounding and Bonding for Communications Systems"

1.3 REFERENCES

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

1. General:

a. National Electrical Code (NEC)

b. National Electrical Safety Code (NESC)

c. Occupational Safety and Health Act (OSHA)

2. Communications:

a. ANSI/TIA/EIA - 568: *Commercial Building Telecommunications Cabling Standard*

b. ANSI/TIA/EIA - 569: *Commercial Building Standard for Telecommunication Pathways and Spaces*

c. ANSI/TIA/EIA - 606: *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*

d. ANSI/TIA/EIA - 607: *Commercial Building Grounding and Bonding Requirements for Telecommunications*

e. ISO/IEC IS 11801: *Generic Cabling for Customer Premises*

f. BICSI: *BICSI Telecommunications Cabling Installation Manual*

g. BICSI: *BICSI Telecommunications Distribution Methods Manual (TDMM)*

1.4 DEFINITIONS

A. “EMT” shall mean Electrical Metallic Tubing.

B. “RMC” shall mean Rigid Metal Conduit.

C. “SMR” shall mean Surface Metal Raceway.

D. “Raceway” shall mean any enclosed channel for routing wire, cable or busbars.

E. “TMGB” shall mean *Telecommunications Main Grounding Busbar.* There is typically one TMGB per building, located in the main telecommunications room. This busbar is directly bonded to the electrical service ground.

F. “TGB” shall mean *Telecommunications Grounding Busbar.* There is typically one TGB per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems.

G. “TBB” shall mean *Telecommunications Bonding Backbone.* The TBB is a conductor used to connect TMGBs to the TGBs.

H. “Pullbox” shall mean a metallic box with a removable cover, used to facilitate pulling cable through conduit runs longer than 100’ or in which there are more than 180 degrees of bends.

I. “Junction box” shall mean a pullbox wherein a feeder conduit transitions to multiple distribution conduits.

1.5 SYSTEM DESCRIPTION

A. Furnish, install, and place into satisfactory and successful operation all materials, devices, and necessary appurtenances to provide a complete Raceway system as hereinafter specified and/or shown on the Contract Documents. The Raceway system shall support an ANSI/TIA/EIA and ISO/IEC compliant communications Structured Cabling System (SCS) as specified in 2715 00 - Inside Plant Communications Systems

B. The work shall include materials, equipment and apparatus not specifically mentioned herein or noted on the Contract Documents but which are necessary to make a complete working Raceway system.

1.6 SUBMITTALS

A. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.

1. Submit a letter stating that the materials will be provided as specified, and specifically listing any items that will not be provided as specified. The letter shall also state that the Contractor has reviewed the specified items and agrees that they are applicable to this project in all respects.

2. For those items noted as allowing “or equal,” and which are not being provided as specifically named, submit standard manufacturer's cut sheets or other descriptive information, along with a written description detailing the reason for the substitution.

3. Provide standard manufacturer’s cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

B. Closeout Submittals: Provide submittal information for review as follows:

1. O&M Manual for Communications - At the completion of the project, submit all O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to the College in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description.

2. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of redline markups of drawings, specifications and spreadsheets, including maintenance hole/handhole butterfly drawings.

   a. Document changes to the system from that originally shown on the Contract Documents and clearly identify system component labels and identifiers on Record Drawings.

   b. Keep Record Drawings at the job site and make available to the Owner and Designer at any time.

   c. Keep Record Drawings current throughout the course of construction. (“Current” is defined as not more than one week behind actual construction).

   d. Show identifiers for major infrastructure components on Record Drawings.

1.7 CONTRACTOR WARRANTY:

A. Provide a Contractor-endorsed one-year service warranty against defects in materials and workmanship.

   1. Provide labor attributable to the fulfillment of this warranty at no cost to the Owner.

   2. The Contractor Warranty period shall commence upon Owner acceptance of the work.

1.8 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

   1. The Terms "Listed" and "Labeled": As defined in NEC, Article 100.

   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NECA's "Standard of Installation."

C. Comply with NEC.

1.9 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall consist of conduit, surface metal raceway, outlet boxes, fittings, enclosures, pull boxes, and other raceway incidentals and accessories as required for inside plant communications circuits.

2.2 MATERIALS

A. Conduit:

1. EMT. 1” minimum conduit size. Flexible metal conduit (FMC) is not acceptable.

a. Conduit: Galvanized steel tubing meeting ANSI C80.3.

b. Couplings: Steel, cast iron, or malleable iron compression type employing a split, corrugated ring and tightening nut, with integral bushings and locknuts. Indent-type and setscrew-type couplings are not permitted.

2. RMC. 1” minimum conduit size.

a. Conduit: Hot dipped galvanized steel with threaded ends meeting ANSI C80.1.

b. Couplings: Unsplit, NPT threaded steel cylinders with galvanizing equal to the conduit.

c. Nipples: Same as conduit, factory-made up to 8 inches in diameter, no running threads.

B. Sleeves: EMT conduit, with insulated throat bushings for each end

C. Surface Raceway: Wiremold V2400 series or equivalent – Two piece, steel, single channel surface raceway.

D. Outlet boxes: Minimum 4”x4” size, 2 1/8” minimum depth, with extension rings (if needed) and single gang covers (i.e.; mud rings), unless otherwise noted on the Contract Documents. Combined interior depth of outlet box, extension ring and cover shall be a minimum 2-1/2”. Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for 1” trade size conduit or connector entrance, meeting NEMA OS 1.

1. Acceptable manufacturers:

a. Appleton, Raco, Steel City, or equal

2. Wiremold Extra Deep Switch and Receptacle Box: V5744-2 (two gang), or equal

E. Junction Boxes and Pull Boxes: Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance. Boxes 6”x6”x4” or larger may be code gauge fabricated steel continuously welded at seams and painted after fabrication.

1. Dry locations: meeting NEMA OS 1.

2. Wet locations: NEMA OS 3R.

F. Miscellaneous Fittings:

1. Locknuts and conduit bushings: Malleable iron

a. Appleton, Crouse Hinds, OZ Gedney, or equal

2. Through wall seals and floor seals shall be:

a. OZ Gedney FS and WS series, or equal.

G. Pull Strings: Plastic or nylon with a minimum test rating of 200 lb.

2.3 FIRESTOPPING

A. Material: Conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions.

2.4 LABELING AND ADMINISTRATION

A. Labels: As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, typed, and created by a hand-carried label maker or an approved equivalent software-based label making system. Handwritten labels are not acceptable.

1. Hand-carried label maker:

a. Brady: ID Pro Plus (or approved equal).

2. Labels:

a. Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal).

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 -- REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

E. Install the raceway system in a manner ensuring that communications circuits, when installed, are able to fully comply with the ANSI/TIA/EIA and other references listed in Part 1 — References, above.

F. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

G. Remove surplus material and debris from the job site and dispose of legally.

3.2 EXAMINATION

A. Examine surfaces and spaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway

installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions. Provide a raceway for each location indicated. Do not gang raceway into wireways, pullboxes, junction boxes, etc., without specific approval from the Designer.

B. Conduit:

1. Install EMT unless other conduit is shown on the Contract Documents or is required by Code.

2. Install conduit as a complete, continuous system without wires, mechanically secured and electrically connected to metal boxes, fittings and equipment. Blank-off unused openings using factory-made knockout seals.

3. Run conduit in the most direct route possible, parallel to building lines. Do not route conduit through areas in which flammable material may be stored.

4. Keep conduit at least 6 inches away from parallel runs of flues and steam or hot-water pipes or other heat sources operating at temperatures above one-hundred degrees Fahrenheit. Install horizontal conduit runs above water piping.

5. Keep conduit away from sources of electromagnetic interference as follows:

a. 5 inches from fluorescent lighting

b. 12 inches from conduit and cables used for electrical power distribution

c. 48 inches from motors or transformers

6. Do not exceed 90 meters total length for a given conduit run to be used for distribution cabling (from outlet box to telecommunications room), including intermediate conduits and junction boxes.

7. Install conduit exposed, except in finished areas or unless shown otherwise on the drawings. Do not install conduit below grade/slab unless specifically shown on the Contract Documents as being installed below grade/slab.

8. Install exposed conduit in lines parallel or perpendicular to building lines or structural members except where the structure is not level. Follow the surface contours as much as practical. Do not install crossovers or offsets that can be avoided by installing the conduit in a different sequence or a uniform line.

a. Run parallel or banked conduits together, on common supports where practical.

b. Make bends in parallel or banked runs from same centerline to make bends parallel.

9. Conduits concealed above ceilings, furred spaces, etc., which are normally inaccessible may be run at angles not parallel to the building lines.

10. Wherever practical, route conduit with adjacent ductwork or piping and support on common racks. Base required strength of racks, hangers, and anchors on combined weights of conduit and piping.

11. Where conduits cross building expansion joints, use suitable sliding or offsetting expansion fittings. Unless specifically approved for bonding, use a suitable bonding jumper.

12. Support conduits as specified in Section "Basic Electrical Materials and Methods."

    a. Provide anchors, hangers, supports, clamps, etc. to support the conduits from the structures in or on which they are installed. Do not space supports farther apart than five feet.

    b. Provide sufficient clearance to allow conduit to be added to racks, hangers, etc. in the future.

    c. Support conduit within three feet of each outlet box, junction box, gutter, panel, fitting, etc.

13. Ream conduits to eliminate sharp edges and terminate with metallic insulated grounded throat bushings. Seal each conduit after installation (until cable is installed) with a removable mechanical-type seal to keep conduits clean, dry and prevent foreign matter from entering conduits.

14. Install a pull string in each conduit.

15. For conduits entering through the floor of a telecommunications room, terminate conduits 6” above the finished floor.

16. Do not install communications conduits in wet, hazardous or corrosive locations.

17. Where conduit is shown embedded in masonry, embed conduit in the hollow core of the masonry. Horizontal runs in the joint between masonry units are not permitted.

18. Where conduit is shown embedded in concrete, embed conduit a minimum of two inches from the exterior of the concrete. Do not place conduit in concrete less than 4 inches thick.

    a. One inch trade size conduit shall be used. Conduits sized smaller than one inch trade size conduit are not permitted embedded in concrete without approval from the College.

    b. Run conduit parallel to main reinforcement.

    c. Conduit crossovers in concrete are not permitted.

19. Where conduit exits from grade or concrete, provide a rigid steel elbow and adapter.

20. Where conduit enters a space through the floor and terminates in that space, terminate the conduit at 6” above the finished floor.

21. Where conduits terminate at a cable tray, the conduits shall be consistently terminated no more than 8” from the cable tray, and have a visually uniform appearance.

22. Where several circuits follow a common route, stagger pullboxes or fittings.

23. Where several circuits are shown grouped in one box, individually fireproof each conduit.

24. Bend and offset metal conduit with standard factory sweeps or conduit fittings. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

a. Conduit sweeps:

1) Sweeps shall not exceed 90 degrees.

2) Do not exceed 180 degrees for the sum total of conduit sweeps for a section of conduit (between conduit termination points).

3) Sweep radius shall be at least 10 times the internal diameter of the conduit.

4) 90-degree condulets (LB's) and electrical elbows are not acceptable.

b. Factory-manufactured sweeps are required for bends in conduit larger than 1-¼" trade size.

c. For bends in 1 ¼" trade size conduit and larger, field-manufactured bends (using a hydraulic bender with a 1 ¼" boot) are permitted only when factory-manufactured sweeps are not suitable for the conditions. In all other cases, factory-manufactured sweeps are required. "Hickey-bender" use is prohibited.

25. Connect conduit to hubless enclosures, cabinets and boxes with double locknuts and with insulating type bushings. Use grounding type bushings where connecting to concentric or eccentric knockouts. Make conduit connections to enclosures at the nearest practicable point of entry to the enclosure area where the devices are located to which the circuits contained in the conduit will connect.

26. Penetrations for raceways:

a. Do not bore holes in floor and ceiling joists outside center third of member depth or within two feet of bearing points. Holes shall be 1-¼" diameter maximum.

b. Penetrate finished walls and finished surfaces with a PVC or sheet metal sleeve with an interior diameter (ID) at least 1/4" greater than the outer diameter (OD) of the conduit, set flush with walls, pack with fiberglass, seal with silicone sealant.

c. Penetrate poured-in-place walls and free slabs with a cast iron sleeve (or Schedule 40 PVC black pipe sleeve for above-grade only) with retaining ring or washer. Set sleeves flush with forms or edges of slab. Pack around conduit with fiberglass and seal with silicone sealant.

27. Raceway terminations and connections:

a. Join conduits with fittings designed and approved for the purpose and make joints tight. Do not use set indent-type or screw-type couplings.

b. Make threaded connections waterproof and rustproof by applying a watertight, conductive thread compound. Clean threads of cutting oil before applying thread compound.

c. Make conduit terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.

d. Cut ends of conduit square using a hand saw, power saw or pipe cutter. Ream cut ends to remove burrs and sharp ends. Where conduit threads are cut in the field, cut threads to have same effective length, same thread dimensions and same taper as specified for factory-cut threads.

e. Provide double locknuts and insulating bushings at conduit connections to boxes and cabinets. Align raceways to enter squarely and install locknuts with dished

part against the box. Use grounding type bushings where connecting to concentric or eccentric knockouts.

f. Where conduits are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

28. Install conduit sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed conduits, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

a. Where conduits pass from warm to cold locations, such as the boundaries of air conditioned or refrigerated spaces and where conduits enter or exit buildings from outdoor areas, including underground ducts or conduit runs.

b. Where otherwise required by the NEC.

29. Conduit shall be clean and dry.

C. Sleeves:

1. Provide sleeves where required, sized as noted on the Contract Documents. Where not noted, sleeve sizing shall be determined by the type and quantity of cable to be routed through the sleeve per TIA/EIA 569A cable capacity standards, plus an additional 20% for future expansion.

2. Provide roto-hammering or core drilling where required for installation.

3. Seal between sleeve and wall or floor in which the sleeve is installed. Firestop all penetrations to restore wall or floor to pre-penetration fire-rating.

D. Surface Raceway:

1. Provide surface raceway for all surface mounted telecommunications outlet boxes and as shown on the Contract Documents.

2. Surface raceway shall be routed parallel to and perpendicular to surfaces or exposed structural members, and follow surface contours.

3. Surface raceway color shall match as closely as possible the existing wall finish. Do not paint Surface Raceway.

4. Surface raceway systems shall be completely installed, including insulating bushings and inserts as required by manufacturer’s installation requirements. Unused openings in the surface raceway shall be closed using manufactured fittings.

5. Surface raceway shall have a minimum two inch radius control at all bend points.

6. Surface raceway shall be securely supported by screws or other anchor-type devices at intervals not exceeding 10 feet and with no less than two supports per straight raceway section. Surface raceway shall be securely supported in accordance with the manufacturer’s requirements. Tape and glue are not acceptable support methods.

7. Mechanically and electrically continuous surface raceway shall be bonded and grounded to the Telecommunications Grounding system.

E. Outlet Boxes:

1. Provide outlet boxes and covers as shown on the Contract Documents and as needed. Verify that the appropriate cover type and depth is provided for each type of wall and finish. Provide extension rings as needed.

2. Coordinate box locations with building surfaces and finishes to avoid bridging wainscots, joints, finish changes, etc.

3. Install boxes in dry locations (not wet, corrosive, or hazardous).

4. Attach boxes securely to building structure with a minimum of two fasteners. Provide attachments to withstand a force of one hundred pounds minimum, applied vertically or horizontally.

5. Install boxes at the following heights to the bottom of the box, except where noted otherwise:

   a. Wall mounted telephones: 48” above finished floor.

   b. Workstation outlets: 18” above finished floor.

   c. Place boxes for outlets on cabinets, countertops, shelves, and similar boxes located above countertops two inches above the finished surface or two inches above the back splash. Coordinate and verify size, style, and location with the supplier or installer of these items prior to outlet box installation.

6. Recessed mounted outlet boxes:

   a. Recess boxes in the wall, floor, and ceiling surfaces in finished areas. Set boxes plumb, level, square and flush with finished building surfaces within one-sixteenth inch for each condition. Set boxes so that box openings in building surfaces are within one-eighth inch of edge of material cut-out and fill tight to box with building materials. Single gang opening shall extend at least to the finished wall surface and extend not more than 1/8 inch beyond the finished wall surface. Provide backing for boxes using structural material to prevent rotation on studs or joists.

   b. Install floor boxes level and adjust to finished floor surface.

7. Surface-mounted outlet boxes:

   a. For boxes surface-mounted on finished walls, provide Wiremold outlet box or equivalent. Cut box as necessary to accept conduit.

   b. For boxes surface-mounted on unfinished walls (i.e. electrical rooms, mechanical rooms), provide 4”x4” (minimum) outlet box with single gang cover.

F. Floor Boxes:

1. Provide floor boxes as shown on the Contract Documents.

2. Set device boxes plumb, level, square and flush with floor, within 1/16” tolerance for each condition.

3. For floor boxes with combined power and telecommunications circuits, provide metal dividers to separate power from telecommunications circuits.

G. Junction Boxes:

1. Provide junction boxes as shown on the Contract Documents and as required.

   a. Where sizing is not shown on the Contract Documents, size junction box length and depth according to the size of the feeder conduit in the following table:

Feeder Conduit Size	Box Length	Box Depth
1”	12”	4”
1-¼”	12”	4”
1-½”	12”	4”
2”	24”	4”
2-½”	24”	6”
3	36”	6”
3-½”	48”	6”
4”	60”	6”

   b. Where sizing is not shown on the Contract Documents, size junction box width according to the following formula:

      1) From the table below, select the width associated with the largest conduit on the distribution side of the box. For each additional distribution conduit, add the “Increase Width” value associated with the size of that distribution conduit to the box width for the largest distribution conduit.

         a) For example, if the distribution side of the junction box has one 1-¼” distribution conduit and three 1” distribution conduits, the total distribution-side width would be 6”+2”+2”+2”=10”.

      2) Repeat the above process for the feeder side of the junction box. Junction boxes are typically fed by a single conduit, therefore unless the box has more than one feeder conduit, the “Increase Width” part of the formula is unnecessary.

         a) For example, if the feeder side of the junction box has two 2” feeder conduits the total feeder-side width would be 8”+5”=13”.

      3) The larger of the two width calculations (distribution side vs. feeder side) shall be the width of the junction box to be provided.

         a) For example, if the distribution-side width were 10” and the feeder-side width were 13”, provide a 13” wide junction box.

Conduit Size	Box Width	For each additional conduit Increase Width
1”	4”	2”
1-¼”	6”	3”
1-½”	8”	4”
2”	8”	5”
2-½”	10”	6”
3	12”	6”
3-½”	12”	6”
4”	15”	8”

2. A junction box may not be substituted for a 90-degree bend. *90 degree condulets (LB’s) are not acceptable.*

3. Install junction boxes in a location readily accessible both at time of construction and after building occupation. Do not install junction boxes in inaccessible interstitial building spaces.

4. Where junction boxes are to be mounted on ceiling structure above ceiling grid, do not mount higher than 4’ above grid.

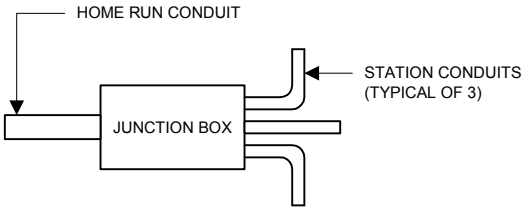
5. Install hinged-cover enclosures and cabinets plumb, and supported at each corner.

6. Install junction boxes so that the access door opens from the side where the cable installer will normally work – typically from the bottom (floor side) of the box.

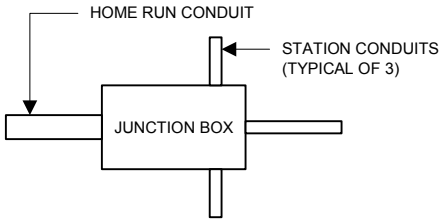
   a. Where a junction box is installed in a ceiling space, coordinate with other trades to provide full access to the junction box door and adequate working room for both the installation personnel and for proper looping of cable during installation.

   b. Provide a lockable access cover (or junction box door if junction box is exposed) in hard lid ceilings.

7. Install junction boxes such that conduits enter and exit at opposite ends of the box as follows:



CORRECT INSTALLATION



INCORRECT INSTALLATION

H. Pull Boxes:

1. Provide pull boxes as shown on the Contract Documents and as required.

a. Where sizing is not shown on the Contract Documents, size pull boxes as follows:

Size of Largest Conduit	Box Width	Box Length	Box Depth
1”	4”	12”	4”
1-¼”	6”	12”	4”
1-½”	8”	12”	4”
2”	8”	24”	4”
2-½”	10”	24”	6”
3	12”	36”	6”
3-½”	12”	48”	6”
4”	15”	60”	6”

b. Where a pull box is required with conduits 1” trade size or smaller, an outlet box may be used as a pull box. Where outlet boxes are used as pull boxes, the outlet boxes shall be dedicated for use as a pull box and shall not host cable termination hardware.

2. A pull box may not be substituted for a 90-degree bend. *90 degree condulets (LB’s) are not acceptable.*

3. Install pull boxes in an accessible location, readily accessible both at time of construction and after building occupation. Do not install pull boxes in inaccessible interstitial building space.

4. Where pull boxes are to be mounted on ceiling structure above ceiling grid, do not mount higher than 4’ above grid (mount on wall instead).

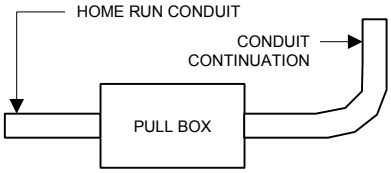
5. Install hinged-cover enclosures and cabinets plumb, and supported at each corner.

6. Install pull boxes so that the access door opens from the side where the cable installer will normally work (typically from the bottom, or floor side, of the box).

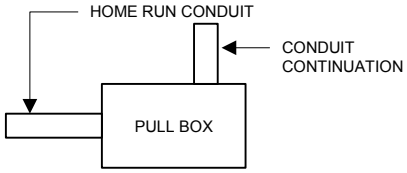
   a. Where a pull box is installed in a ceiling space, provide full access to the junction box door and adequate working room for both the installation personnel and for proper looping of cable during installation.

   b. Provide a lockable access cover (or pull box door if pull box is exposed) in hard lid ceilings.

7. Install pull boxes such that conduits enter and exit at opposite ends of the box as follows:



CORRECT INSTALLATION



INCORRECT INSTALLATION

I. Firestopping:

1. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.

2. Maintain fire rating of penetrated fire-rated walls. Firestop and seal each penetration made during construction.

   a. Provide firestopping material for through and membrane penetrations of fire-rated barriers.

   b. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.

   c. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer's recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply all sealing material in a manner acceptable to the local fire and building authorities.

J. Grounding/Bonding: Grounding and bonding work shall comply with the Virginia Uniform Statewide Building Code, Uniform Fire Code, National Electrical Code, and UL 467, ANSI/TIA/EIA standards and the references listed in PART 1 – REFERENCES above, as well as local codes which may specify additional grounding and/or bonding requirements.

1. Bond metallic raceway together and to the nearest TGB (as provided under Division 27 Section — "Grounding and Bonding for Communications Systems"). Ensure that bonding breaks through paint to bare metallic surface of painted metallic hardware.

3.4 LABELS:

A. Conduits: For any conduit extending beyond the space or room in which it starts, label each such conduit end in a clear manner by designating the location of the other end of the conduit (i.e. room name, telecommunications room name, pull box identifier, outlet identifier (use the label of the first port of the outlet as the outlet identifier), etc.). Indicate conduit length on the label.

1. Where a conduit is intended for future cabling use outside of the Contract, the conduit shall be labeled in a clear manner by designating the location of the other end of the conduit (i.e. room name, telecommunications room name, pull box identifier, etc.) along with a sequential number for each spare conduit terminated into a single room. Indicate conduit length on the label.

   a. Suggestion: The second spare conduit (whether spare or in use) between Room 100 and telecommunications room 1A might be labeled in the telecommunications room as "Room 100 - #2, __ feet." In Room 100 the same conduit might be labeled "1A - #2, __ feet."

B. Pull Boxes: Label each pullbox with a unique identifier. Identifiers shall be of the form “RN-Y” where “RN” is the room name of the room closest to (or containing) the pull box, and “Y” is the sequential number of the pull box for each “RN”.

1. Example: The second pull box in the vicinity of room “100” would have the label “100-2”.

C. Pull Strings: For any conduit extending beyond the space or room in which it starts, label its pull string in a clear manner by designating the location of the other end of the pull string (i.e. room name, telecommunications room name, pull box identifier, outlet identifier (use the label of the first port of the outlet as the outlet identifier), etc.).

1. Where a pull string is installed in a conduit intended for future cabling use outside of the Contract, the pull string shall be labeled similar to the spare conduit in which it is installed.

3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and in accordance with accepted industry practice, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.6 CLEANING

1. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 28 58 00

DIVISION 31 – EARTHWORK

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, removing site utilities and abandoning site utilities in place.
7. Temporary erosion- and sedimentation-control measures.

B. Related Sections:

1. Section 024119 "Selective Demolition" for partial demolition of buildings or structures.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify Miss Utility for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.

2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag Wrap a 1-inch blue vinyl tie tape flag around each tree trunk at 54 inches above the ground.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. See approved permit drawings.

3.3 TREE AND PLANT PROTECTION

A. See contract drawings.

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than seven days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 4 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Preparing subgrades for slabs-on-grade walks pavements turf and grasses and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subsurface drainage backfill for walls and trenches.
6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:

1. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
3. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Warning tapes.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698 or ASTM D 1557.

1.6 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

B. Preexcavation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify "Miss Utility" for area where Project is located before beginning earth moving operations.

D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 311000 "Site Clearing," are in place.

E. Do not commence earth moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

F. Moisture Sensitive Soils:
1. The on-site founding materials are moisture sensitive and will be easily disturbed by excessive construction activity.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve. Reclaimed Asphalt Pavement (RAP) which meets the requirements above can classified as engineered fill. See moisture testing requirements, section 2.14, C.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
3. Permittivity: 0.5 per second, minimum; ASTM D 4491.
4. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type I Type II or Type III.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch (19-mm) nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 36 to 42 lb/cu. ftat point of placement, when tested according to ASTM C 138/C 138M.
2. Compressive Strength: 140 psi (965 kPa) , when tested according to ASTM C 495.

2.4 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 6 inches beneath bottom of concrete slabs-on-grade.
    f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavation for Slab on Grade: A minimum 12” of newly placed compacted fill not including the below slab stone is required below slab-on-grade to minimize any movement due to volume changes of the underlying clay soils. The procedure to be followed shall be as follows:

    A. Excavate to 12” below the proposed slab stone subgrade.
    B. Densify, proof roll and prepare the existing subbase including the removal of existing and unsuitable soils.
    C. Within 8 hours of excavation, cover the entire prepared subbase with sheet vapor retarder per 03 30 00 “Cast-in-place Concrete.”
    D. Place a minimum of 12” of compacted fill or crushed stone to underside of below slab stone within an 8 hour period.
    E. Place 4” of granular fill above; a layer of sheet vapor retarder lapped 12” at all edges; all required slab reinforcing, construction joints, etc.; and pour concrete floor slab.

2. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.8 SUBGRADE INSPECTION

A. Notify geotechnical engineer when excavations have reached required subgrade.

B. If geotechnical engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph .
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by geotechnical engineer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by geotechnical engineer, without additional compensation.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

C. The exterior side of all exterior foundation walls and footings are required to be backfilled with in-site material or flowable fill within 12 inches of final exterior grades.

3.11 UTILITY TRENCH BACKFILL

A. Where utility lines cross from the building exterior to interior, the trench shall be backfilled with flowable fill 5 feet on either side of the building.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

C. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

D. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete"

E. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete"."

F. Backfill voids with satisfactory soil while removing shoring and bracing.

G. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 3 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

B. Moisture Sensitive Soils:
1. The on-site founding materials are moisture sensitive and will be easily disturbed by excessive construction activity.
2. The exposed founding materials shall be protected against detrimental changes in engineering qualities as a result of disturbance from rain or frost.
3. Surface runoff shall be drained away from excavations and not allowed to pond.
4. If possible, concrete shall be placed in the footings the same day the excavations are made, or the founding materials may be covered by mud mats in order to protect the founding soil from becoming too saturated due to forecasted precipitation and/or disturbed due to excessive construction activity during the placement of steel reinforcement.
5. The presence of moisture sensitive fine-grained soils poses the potential for high moisture content. Soils may be found to be at or near their plastic limit; consequently, the on-site soils may require disking, aeration, and/or manipulation to achieve efficient compaction.
6. Any regions exhibiting poor drainage characteristics, and low lying areas, shall be expected to display moisture contents which are excessively high for normal earthwork operations.
7. Any standing water shall be drained or pumped into approved sediment control facilities prior to commencement of earthwork.
8. Excavations near to subgrade and all fills should be protected from heavy equipment traffic, including heavy compaction equipment, when on-site soils exhibit high moisture content, in order to minimize pumping and a generalized deterioration of these materials.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Testing of moisture using nuclear gauges is affected by presence of Reclaimed Asphalt Pavement (RAP). Moisture contact tend to be over-estimated. Laboratory moisture checks should be completed to calibrate nuclear density guage moisture content readings where RAP is utilized.

D. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 or ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1/4 inch.
3. Pavements: Plus or minus 1/4 inch.

3.16 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: As shown on plans.

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.

4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698 or ASTM D 1557.

3.18 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

A. Special Inspections: Contractor will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Contractor will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Hot-mix asphalt patching.
2. Hot-mix asphalt paving.
3. Hot-mix asphalt overlay.

B. Related Requirements:

1. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.
2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
3. Job-Mix Designs: For each job mix proposed for the Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.

B. Material Certificates: For each paving material.

C. Material Test Reports: For each paving material, by a qualified testing agency.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by Baltimore County.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Baltimore County for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Tack Coat: Minimum surface temperature of 60 deg F.
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320

B. Cutback Prime Coat: ASTM D 2027, medium-curing cutback asphalt, MC-30 or MC-70.

C. Emulsified Asphalt Prime Coat: ASTM D 977, slow setting, diluted in water, of suitable grade and consistency for application.

D. Tack Coat: ASTM D 977, slow setting, diluted in water, of suitable grade and consistency for application.

E. Fog Seal: ASTM D 977 emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

F. Water: Potable.

G. Undersealing Asphalt: ASTM D 3141/D 3141M; pumping consistency.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires, asphalt shingles or glass from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

C. Sand: ASTM D 1073 or AASHTO M 29, Grade No. 2 or No. 3.

D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

E. Joint Sealant: ASTM D 6690 or AASHTO M 324, hot-applied, single-component, polymer-modified bituminous sealant.

2.4 MIXES

A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by Baltimore County

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Geotechnical Engineer, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of

adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

D. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

E. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated on drawings.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.6 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/8 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.8 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

    a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 WASTE HANDLING

A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 32 12 16

SECTION 321313

CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Curbs and gutters.
2. Walks.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

Credit MR 4: RECYCLED CONTENT MATERIALS. Maximize the use of materials with high percentages of post-consumer and/or pre-consumer (also referred to as post-industrial) recycled content. Recycled content shall be defined in accordance with the International Organizations for Standardization document ISO 14021 – Environmental labels and declarations – Self-declared environmental claims (Type II Environmental labeling). Post-consumer material is defined as waste material generated by household or commercial and institutional facilities in their role as end-users of the product, which can no longer be used for its intended purpose. Pre-consumer material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of material such as re-work re-grind, or scrap generated in a process capable of being reclaimed within the same process that generated it.

Credit MR 5: REGIONALLY MANUFACTURED, HARVESTED/EXTRACTED/RECOVERED MATERIALS. Maximize use of building materials or products that have been mined, extracted, harvested or recovered as well as manufactured within a 500 miles of the project site. If only a

fraction of a product or material is extracted/harvested/recovered and manufactured locally within 500 miles, then only that percentage (by weight) shall contribute to the regional value.

Mechanical, electrical and plumbing components and specialty items shall be excluded. Only materials permanently installed in the project from divisions 2-10 shall be included.

1. Product Certificates for Credit MR 4:

    a. LEED Material Submittal Form_2010 must be completed by all contractors installing products in divisions 2-10 indicating the product or material, manufacturer, cost of material only (minus tax, shipping, labor and overhead) and percentage of post-consumer and pre-consumer percentages of recycled content.
    b. Provide cut-sheets, manufacturer literature or letter indicated quantities of recycled content, highlighting the percentage of post-consumer and/or post-industrial recycled content material.

2. Product Certificates for Credit MR 5:

    a. LEED Material Submittal Form_2010 must be completed by all contractors indicating the product or material, manufacturer, cost of material only (minus tax, shipping, labor and overhead) and location of extraction/harvest/recovery and manufacturing location.
    b. In order to verify that the extraction, harvest, recovery and manufacture site is located within a 500 mile radius of the project site, project teams are required to indicate the actual mileage between the project site and the manufacturer and similarly, the distance between the project site and the extraction site for each raw material in the submittal template. ALTERNATIVELY, a statement on the manufacturer's letter head indicating that the point of extraction, harvest, recovery or manufacture is within 500 miles of the LEED project site, will also be accepted as part of the LEED documentation and credit submittals.
    c. Submittals will be rejected if any of the required fields on the LEED Submittal Sheets are incomplete.

C. Other Action Submittals:

1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.

B. Material Test Reports: For each of the following:

1. Aggregates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Concrete Testing Service: Contractor to engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

1.7 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150, gray portland cement Type I. Supplement with the following:

a. Fly Ash: ASTM C 618, Class C or Class F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag Type IP, portland-pozzolan cement.

B. Normal-Weight Aggregates: ASTM C 33, Class 4M , uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C 260.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2.3 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:

a. Axim Italcementi Group, Inc.; Caltexol CIMFILM.
b. BASF Construction Chemicals, LLC; Confilm.
c. ChemMasters; Spray-Film.
d. Conspec by Dayton Superior; Aquafilm.
e. Dayton Superior Corporation; Sure Film (J-74).
f. Edoco by Dayton Superior; BurkeFilm.
g. Euclid Chemical Company (The), an RPM company; Eucobar.
h. Kaufman Products, Inc.; VaporAid.
i. Lambert Corporation; LAMBCO Skin.
j. L&M Construction Chemicals, Inc.; E-CON.
k. Meadows, W. R., Inc.; EVAPRE.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group; MONOFILM.
n. Sika Corporation, Inc.; SikaFilm.
o. SpecChem, LLC; Spec Film.
p. Symons by Dayton Superior; Finishing Aid.
q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
r. Unitex; PRO-FILM.
s. Vexcon Chemicals Inc.; Certi-Vex EnvioAssist.

2.4 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less

than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types I and II, non-load bearing Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ChemMasters; Exposee.
b. Conspec by Dayton Superior; Delay S.
c. Dayton Superior Corporation; Sure Etch (J-73).
d. Edoco by Dayton Superior; True Etch Surface Retarder.
e. Euclid Chemical Company (The), an RPM company; Surface Retarder Formula S.
f. Kaufman Products, Inc.; Expose.
g. Meadows, W. R., Inc.; TOP-STOP.
h. Metalcrete Industries; Surftard.
i. Nox-Crete Products Group; CRETE-NOX TA.
j. Scofield, L. M. Company; LITHOTEX Top Surface Retarder.
k. Sika Corporation, Inc.; Rugasol-S.
l. SpecChem, LLC; Spec Etch.
m. TK Products, Division of Sierra Corporation; TK-6000 Concrete Surface Retarder.
n. Unitex; TOP-ETCH Surface Retarder.
o. Vexcon Chemicals Inc.; Certi-Vex Envioset.

F. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

2.5 DETECTABLE WARNING MATERIALS

A. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advanced Surfaces Inc.
b. Matcrete Precision Stamped Concrete Tools.
c. Southern Color N.A., Inc.
d. Stampcrete International Ltd.
e. Superior Decorative by Dayton Superior.

2. Size of Stamp: One piece matching detectable warning area shown on Drawings.

B. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Advanced Surfaces Inc.; Liquid Release.
b. Matcrete Precision Stamped Concrete Tools; Liquid Release Agent.
c. Southern Color N.A., Inc.; SCC Clear Liquid Release.
d. Stampcrete International Ltd.; Stampcrete Liquid Release.
e. Superior Decorative by Dayton Superior; Pro Liquid Release.

2.6 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than three 45 minutes.

1. Color: As indicated.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 3500 psi
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches , plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 5 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.

D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use high-range, water-reducing and retarding admixture in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Fly Ash or Pozzolan: 25 percent.
4. Ground Granulated Blast-Furnace Slag: 50 percent.

5. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F , reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F , reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd.or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd. , increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent or epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

   a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

   a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F , uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature,

provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
2. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 DETECTABLE WARNINGS

A. Stamped Detectable Warnings: Install stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.

1. Before using stamp mats, verify that the vent holes are unobstructed.
2. Apply liquid release agent to the concrete surface and the stamp mat.
3. Stamping: While initially finished concrete is plastic, accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.
4. Trimming: After 24 hours, cut off the tips of mortar formed by the vent holes.
5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing moisture-retaining-cover curing curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.11 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.

   a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.13 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer.

B. Drill test cores, where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373

CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.

B. Related Sections:

1. Section 321216 "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
2. Section 321313 "Concrete Paving" for constructing joints in concrete pavement.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, Samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit no fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint-preparation data that are based on previous testing, not older than 24 months, of sealant products for compatibility with and adhesion to joint substrates and other materials matching those submitted.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Pavement-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer or testing agency.

B. Product Certificates: For each type of joint sealant and accessory, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.

D. Preconstruction Compatibility and Adhesion Test Reports: From joint-sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility with and adhesion to joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.7 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.

1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:

a. Crafco Inc., an ERGON company; RoadSaver Silicone.
b. Dow Corning Corporation; 888.
c. Pecora Corporation; 301 NS.

B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Crafco Inc., an ERGON company; RoadSaver Silicone SL.
b. Dow Corning Corporation; 890-SL.
c. Pecora Corporation; 300 SL.

C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; Urexpan NR-200.

2.3 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant for Concrete: ASTM D 3406.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Crafco Inc., an ERGON company; Superseal 402/117.

B. Hot-Applied, Single-Component Joint Sealant for Concrete and Asphalt: ASTM D 6690, Types I, II, and III.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Meadows, W. R., Inc.; Sealtight Hi-Spec Sealtight 3405.

b. Right Pointe; D-3405 Hot Applied Sealant.

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place joint sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1. Remove excess joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING

A. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.6 PAVEMENT-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within cement concrete pavement.

1. Joint Location:

a. Expansion and isolation joints in cast-in-place concrete pavement.
b. Contraction joints in cast-in-place concrete slabs.

c. Other joints as indicated.

2. Silicone Joint Sealant for Concrete: Single component, nonsag Single component, self-leveling.
3. Urethane Joint Sealant for Concrete: Multicomponent, pourable, traffic-grade .
4. Hot-Applied Joint Sealant for Concrete: Single component.
5. Joint Location:

a. Expansion and isolation joints in cast-in-place concrete pavement.
b. Contraction joints in cast-in-place concrete slabs.
c. Other joints as indicated.

B. Joint-Sealant Application: Joints between cement concrete and asphalt pavement PJS-#.

1. Joint Location:

a. Joints between concrete and asphalt pavement.
b. Joints between concrete curbs and asphalt pavement.
c. Other joints as indicated.

2. Hot-Applied Joint Sealant for Concrete and Asphalt: Single component.

END OF SECTION 321373

SECTION 321723

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes painted markings applied to pavement.

B. Related Requirements:

1. Section 099113 "Exterior Painting" for painting exterior concrete surfaces other than pavement.
2. Section 099123 "Interior Painting" for painting interior concrete surfaces other than pavement.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Baltimore County for pavement-marking work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, colors complying with FS TT-P-1952.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal..

3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

SECTION 32 18 16.13

Addendum #05

PLAYGROUND PROTECTIVE SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Unitary, seamless surfacing.

1.3 DEFINITIONS

A. Definitions in ASTM F 2223 apply to Work of this Section.

B. Critical Height: Standard measure of shock attenuation according to ASTM F 2223; same as "critical fall height" in ASTM F 1292. According to ASTM F 1292, this approximates "the maximum fall height from which a life-threatening head injury would not be expected to occur."

C. SBR: Styrene-butadiene rubber.

D. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F 2223.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Shop Drawings: For each type of protective surfacing.

1. Include plans, sections, placement and penetration details, and attachment to substrates.
2. Include accessories and edge terminations.
3. Include fall heights and use zones for equipment and structures.

D. Samples for Initial Selection: For each type of exposed finish.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of protective surfacing and exposed finish.

1. Include Samples of accessories to verify color and finish selection.
2. Unitary, Seamless Surfacing: Minimum 9 by 9 inches.

F. Product Schedule: For protective surfacing.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Material Certificates: For each type of loose-fill surfacing.

C. Product Certificates: For each type of unitary surfacing product.

D. Field quality-control reports.

E. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground protective surfacing to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for materials and execution.

1. Build mockups for protective surfacing including accessories.

a. Size: 48 inches by 48 inches.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Reduction in impact attenuation as measured by reduction of critical fall height.
b. Deterioration of protective surfacing and other materials beyond normal weathering.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain protective surfacing materials from single source from single manufacturer.

1. Provide geosynthetic accessories of each type from source recommended by manufacturer of protective surfacing materials.

2.2 PERFORMANCE REQUIREMENTS

A. Impact Attenuation: Critical fall height tested according to ASTM F 1292.

B. Accessibility Standard: Minimum surfacing performance according to ASTM F 1951.

2.3 UNITARY, DUAL-DENSITY, SEAMLESS SURFACING

A. Description: Manufacturer's standard, site-mixed and applied, two-layer material with wearing layer over cushioning layer, with combined, overall thickness as required, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951.

1. Manufacturer: Surface America, Inc.

2. Surfacing System: PlayBound Poured-In-Place, Extreme 10.
3. Wearing Layer: Formulation of EPDM rubber particles, binder, and other organic and inorganic components.
4. Cushioning Layer: Formulation of SBR particles and binder.
5. Binder: Weather-resistant, UV-stabilized, flexible, nonhardening, 100 percent solids polyurethane.
6. Lacquer Topcoat: Manufacturer's standard polyurethane-based formulation.
7. Critical Height: 9 feet.
8. Overall Thickness: Not less than 5-1/2 inches.
9. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location.
10. Wearing Layer Color(s): As selected by Architect from manufacturer's full range.

B. Leveling and Patching Material: Portland cement-based grout or epoxy- or polyurethane-based formulation suitable for exterior use and approved by protective surfacing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.

1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.

3.3 INSTALLATION OF SEAMLESS SURFACING

A. Mix and apply components of seamless surfacing according to manufacturer's written instructions to produce uniform, monolithic, and impact-attenuating protective surfacing of required overall thickness.

1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
2. Poured Cushioning Layer: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
3. Intercoat Primer: Over cured cushioning layer, apply primer at manufacturer's standard spreading rate.
4. Wearing Layer: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with no cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.
5. Lacquer Topcoat: Spray or roller applied at manufacturer's standard coating rate in one continuous operation.
6. Edge Treatment: Extended surface course. Fully adhere edges to substrate with full coverage of substrate. Maintain fully cushioned thickness required to comply with performance requirements.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Perform the following tests with the assistance of a factory-authorized service representative:

1. Perform "Installed Surface Performance Test" according to ASTM F 1292 for each protective surfacing type and thickness in each playground area.
2. Perform installed-surface-performance tests at no less than one series of tests for each 1000 sq. ft. of each type and thickness of in-place protective surfacing or part thereof.

C. Playground protective surfacing will be considered defective if it does not pass tests.

D. Prepare test reports.

3.5 PROTECTION

A. Prevent traffic over seamless surfacing for not less than 48 hours after installation.

END OF SECTION 32 18 16.13

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes chain-link fences and swing gates.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7

1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 12 feet high, and post spacing not to exceed 10 feet .
2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:

a. Fence Height: 8 feet.
b. Material Group: Schedule 40 steel pipe

1.3 SUBMITTALS

A. Product Data: For each type of product indicated

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each polymer-coated product and for each color and texture specified, in 6-inch lengths for components and on full-sized units for accessories.

D. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Product Certificates: For each type of chain-link fence and gate, from manufacturer.

F. Product Test Reports: For framing strength according to ASTM F 1043.

G. Operation and maintenance data.

H. Sample of special warranty.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire Fabric: Wire with a diameter of 0.192 inch.

a. Mesh Size: 2 inches.
b. Polymer-Coated Fabric: ASTM F 668, Class 1 over aluminum-coated steel wire.
1) Color: Black or as selected by Architect from manufacturer's full range, complying with ASTM F 934.

3. Aluminum Wire Fabric: ASTM F 1183, with mill finish, and wire diameter of 0.148 inch.

a. Mesh Size: 2 inches.

4. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:

1. Fence Height: 96 inches.
2. Light Industrial Strength: Material Group IC-L, round steel pipe, electric-resistance-welded pipe.

a. Line Post: 2.375 inches in diameter.
b. End, Corner and Pull Post: 2.375 inches.

3. Horizontal Framework Members: Intermediate, top and bottom rails complying with ASTM F 1043.

4. Brace Rails: Comply with ASTM F 1043.

5. Metallic Coating for Steel Framing:

a. Type A zinc coating.
b. Type B zinc with organic overcoat.

c. External, Type B zinc with organic overcoat and internal, Type D zinc-pigmented coating.
d. Type C, Zn-5-Al-MM alloy coating.
e. Coatings: Any coating above.

6. Polymer coating over metallic coating.

a. Color: Match chain-link fabric complying with ASTM F 934.

2.3 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

D. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

E. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

F. Post Setting: Set posts in concrete with mechanical anchors at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, mixed and placed to

comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

G. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings.

H. Line Posts: Space line posts uniformly at 10 feet o.c.

END OF SECTION 323113

SECTION 323223

SEGMENTAL RETAINING WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes single and multiple depth segmental retaining walls with and without soil reinforcement.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for segmental retaining wall footings.
2. Section 312000 "Earth Moving" for excavation for segmental retaining walls.

1.3 PERFORMANCE REQUIREMENTS

A. Basis of Design: Design of segmental retaining walls is based on products indicated. If comparable products of other manufacturers are proposed, provide engineering design for proposed products, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.4 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform the following preconstruction testing:

1. Test soil reinforcement and backfill materials for pullout resistance according to ASTM D 6706.
2. Test soil reinforcement and backfill materials for coefficient of friction according to ASTM D 5321.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each color and texture of concrete unit required. Submit: full-size units

C. Delegated-Design Submittal: For segmental retaining walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Compliance Review: Qualified professional engineer responsible for segmental retaining wall design shall review and approve submittals and source and field quality-control reports for compliance of materials and construction with design.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For segmental retaining wall units, from manufacturer.

1. Include test data for shear strength between segmental retaining wall units according to ASTM D 6916.
2. Include test data for connection strength between segmental retaining wall units and soil reinforcement according to ASTM D 6638.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for segmental retaining wall units.

1. Include test data for freeze-thaw durability of segmental retaining wall units.
2. Include test data for shear strength between segmental retaining wall units according to ASTM D 6916.
3. Include test data for connection strength between segmental retaining wall units and soil reinforcement according to ASTM D 6638.

C. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to segmental retaining walls including, but not limited to, the following:

a. Structural load limitations.
b. Construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
c. Field quality-control procedures.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store and handle concrete units and accessories to prevent deterioration or damage due to contaminants, breaking, chipping, or other causes.

B. Store geosynthetics in manufacturer's original packaging with labels intact. Store and handle geosynthetics to prevent deterioration or damage due to sunlight, chemicals, flames, temperatures above 160 deg F (71 deg C) or below 32 deg F (0 deg C), and other conditions that might damage them. Verify identification of geosynthetics before using and examine them for defects as material is placed.

PART 2 - PRODUCTS

2.1 SEGMENTAL RETAINING WALL UNITS

A. Concrete Units: ASTM C 1372, Normal Weight, except that units shall not differ in height more than plus or minus 1/2 inch from specified dimension.

1. Provide units that comply with requirements for freeze-thaw durability.
2. Provide units that interlock with courses above and below by means of [integral lugs or lips] [pins] [clips] [or] [hollow cores filled with drainage fill].

B. Color: Grey, as selected by Architect from manufacturer's full range.

C. Shape and Texture: Provide units of basic shape and dimensions indicated on drawings.

D. Shape and Texture: Provide units matching basic shape, dimensions, and face texture indicated on drawings.

E. Shape and Texture: Provide units of any basic shape and dimensions that will produce segmental retaining walls of dimensions and profiles indicated without interfering with other elements of the Work.

F. Cap Units: Provide cap units of shape indicated on drawings.

G. Special Units: Provide corner units, end units, and other shapes as needed to produce segmental retaining walls of dimensions and profiles indicated and to provide texture on exposed surfaces as indicated.

2.2 INSTALLATION MATERIALS

A. Pins: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

B. Clips: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

C. Cap Adhesive: Product supplied or recommended by segmental retaining wall unit manufacturer for adhering cap units to units below.

D. Leveling Base: Comply with requirements in Section 312000 "Earth Moving" for base material.

E. Drainage Fill: Comply with requirements in Section 334600 "Subdrainage."

F. Reinforced-Soil Fill: Comply with requirements in Section 312000 "Earth Moving" for satisfactory soils.

G. Reinforced-Soil Fill: ASTM D 2487; GW, GP, SW, SP, and SM soil classification groups or a combination of these groups; free of debris, waste, frozen materials, vegetation, and other deleterious matter; meeting the following gradation according to ASTM C 136: 20 to 100 percent passing No. 4 (4.75-mm) sieve, 0 to 60 percent passing No. 40 (0.425-mm) sieve, 0 to 35 percent passing No. 200 (0.075-mm) sieve, and with fine fraction having a plasticity index of less than 20.

H. Nonreinforced-Soil Fill: Comply with requirements in Section 312000 "Earth Moving" for satisfactory soils.

I. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent.

1. Apparent Opening Size: No. 70 to 100 (0.212- to 0.150-mm) sieve, maximum; ASTM D 4751.
2. Minimum Grab Tensile Strength: 110 lb (49.9 kg); ASTM D 4632.
3. Minimum Weight: 4 oz./sq. yd. (132 g/sq. m).

J. Subdrainage Pipe and Filter Fabric: Comply with requirements in Section 334600 "Subdrainage."

K. Soil Reinforcement: Product specifically manufactured for use as soil reinforcement and as follows:

1. Product Type: Molded geogrid made from high-density polyethylene.

2.3 SOURCE QUALITY CONTROL

A. Direct manufacturer to test and inspect each roll of soil reinforcement at the factory for minimum average roll values for geosynthetic index property tests, including the following:

1. Weight.
2. Size.
3. Grab or single-rib strength.
4. Aperture opening.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for excavation tolerances, condition of subgrades, and other conditions affecting performance of segmental retaining walls.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 RETAINING WALL INSTALLATION

A. General: Place units according to NCMA's "Segmental Retaining Wall Installation Guide" and segmental retaining wall unit manufacturer's written instructions.

1. Lay units in running bond.
2. Form corners and ends by, using special units or cutting units with motor-driven saw.

B. Leveling Base: Place and compact base material to thickness indicated and with not less than 95 percent maximum dry unit weight according to ASTM D 698.

1. Leveling Course: At Contractor's option, unreinforced lean concrete may be substituted for upper 1 to 2 inches (25 to 50 mm) of base. Compact and screed concrete to a smooth, level surface.

C. First Course: Place first course of segmental retaining wall units for full length of wall. Place units in firm contact with each other, properly aligned and level.

1. Tamp units into leveling base as necessary to bring tops of units into a level plane.

D. Subsequent Courses: Remove excess fill and debris from tops of units in course below. Place units in firm contact, properly aligned, and directly on course below.

1. For units with lugs designed to fit into holes in adjacent units, lay units so lugs are accurately aligned with holes, and bedding surfaces are firmly seated on beds of units below.
2. For units with lips at front of units, slide units as far forward as possible for firm contact with lips of units below.
3. For units with lips at bottom rear of units, slide units as far forward as possible for firm contact of lips with units below.
4. For units with pins, install pins and align units.
5. For units with clips, install clips and align units.

E. Cap Units: Place cap units and secure with cap adhesive.

3.3 FILL PLACEMENT

A. General: Comply with requirements in Section 312000 "Earth Moving" NCMA's "Segmental Retaining Wall Installation Guide," and segmental retaining wall unit manufacturer's written instructions.

B. Fill voids between and within units with drainage fill. Place fill as each course of units is laid.

C. Place, spread, and compact drainage fill and soil fill in uniform lifts for full width and length of embankment as wall is laid. Place and compact fills without disturbing alignment of units. Where both sides of wall are indicated to be filled, place fills on both sides at same time. Begin at wall and place and spread fills toward embankment.

1. Use only hand-operated compaction equipment within 48 inches (1200 mm) of wall, or one-half of height above bottom of wall, whichever is greater.

2. Compact reinforced-soil fill to not less than 95 percent maximum dry unit weight according to ASTM D 698.

a. In areas where only hand-operated compaction equipment is allowed, compact fills to not less than 90 percent maximum dry unit weight according to ASTM D 698.
b. In areas where fill height exceeds 15 feet (4.5 m,) compact reinforced-soil fill that will be more than 15 feet (4.5 m) below finished grade to not less than 98 percent maximum dry unit weight according to ASTM D 698.
c. In areas where fill height exceeds 30 feet (9 m,) compact reinforced-soil fill that will be more than 30 feet (9 m) below finished grade to not less than 100 percent maximum dry unit weight according to ASTM D 698.

3. Compact nonreinforced-soil fill to comply with Section 312000 "Earth Moving."

D. Place drainage geotextile against back of wall and place layer of drainage fill at least 12 inches wide behind drainage geotextile to within 12 inches of finished grade. Place another layer of drainage geotextile between drainage fill and soil fill.

E. Place a layer of drainage fill at least 12 inches wide behind wall to within 12 inches of finished grade. Place a layer of drainage geotextile between drainage fill and soil fill.

F. Wrap subdrainage pipe with filter fabric and place in drainage fill as indicated[, sloped not less than 0.5 percent to drain].

G. Place impervious fill over top edge of drainage fill layer.

H. Slope grade at top of wall away from wall unless otherwise indicated. Slope grade at base of wall away from wall. Provide uniform slopes that will prevent ponding.

I. Place soil reinforcement in horizontal joints of retaining wall where indicated and according to soil-reinforcement manufacturer's written instructions. Embed reinforcement a minimum of 8 inches into retaining wall and stretch tight over compacted backfill. Anchor soil reinforcement before placing fill.

1. Place additional soil reinforcement at corners and curved walls to provide continuous reinforcement.
2. Place geosynthetics with seams, if any, oriented perpendicular to segmental retaining walls.
3. Do not dump fill material directly from trucks onto geosynthetics.
4. Place at least 6 inches of fill over reinforcement before compacting with tracked vehicles or 4 inches before compacting with rubber-tired vehicles.
5. Do not turn vehicles on fill until first layer of fill is compacted and second layer is placed over each soil-reinforcement layer.

3.4 CONSTRUCTION TOLERANCES

A. Variation from Level: For bed-joint lines along walls, do not exceed 1-1/4 inches in 10 feet (32 mm in 3 m), 3 inches (75 mm) maximum.

B. Variation from Indicated Batter: For slope of wall face, do not vary from indicated slope by more than 1-1/4 inches in 10 feet.

C. Variation from Indicated Wall Line: For walls indicated as straight, do not vary from straight line by more than 1-1/4 inches in 10 feet.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Contractor to engage a qualified testing agency to perform tests and inspections.

B. Comply with requirements in Section 312000 "Earth Moving" for field quality control.

1. In each compacted backfill layer, perform at least 1 field in-place compaction test for each 150 feet or less of segmental retaining wall length.
2. In each compacted backfill layer, perform at least 1 field in-place compaction test for each 24 inches of fill depth and each 50 feet or less of segmental retaining wall length.

3.6 ADJUSTING

A. Remove and replace segmental retaining wall construction of the following descriptions:

1. Broken, chipped, stained, or otherwise damaged units. Units may be repaired if Architect approves methods and results.
2. Segmental retaining walls that do not match approved Samples.
3. Segmental retaining walls that do not comply with other requirements indicated on drawings.

B. Replace units so segmental retaining wall matches approved Samples, complies with other requirements, and shows no evidence of replacement.

END OF SECTION 323223

SECTION 32 92 00

LAWNS, GRASSES AND MEADOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Seeding.
2. Hydroseeding.
3. Sodding.

B. Related Sections:

1. Retain Sections in subparagraphs below that contain requirements Contractor might expect to find in this Section but are specified in other Sections.
2. Division 01 Section "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
3. Division 31 Section "Site Clearing" for protection of existing trees and plantings, topsoil stripping and stockpiling, and site clearing.
4. Division 31 Section "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.

1.3 DESCRIPTION

A. Seeding: This work shall consist of soil preparation, seeding, addition of soil amendments (as determined by the soil test results), mulching, overseeding, and mowing all areas designated for turf establishment as specified in the Contract Documents or as directed by the Owner or Owner’s representative.

B. Sodding: This work shall consist of soil preparation, addition of soil amendments (as determined by the soil test results), watering, and placing grass sod on prepared areas, as specified in the Contract Documents or as directed by the Owner or Owner’s representative.

1.4 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and

molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

E. Planting Soil: Material consisting of standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or, manufactured topsoil; which is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

F. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

G. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

H. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

B. Submit proposed seed mixture for approval.

C. Certification of seed: Submit Manufacturer's certificates of purity and guarantees of germination for each seed mixture in accordance with Maryland Seed Law. Certification of seed shall include the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging. Certifications include, but are not limited to:

1. Certification of each seed mixture for turfgrass sod, including identification of source and name and telephone number of supplier.
2. Certification of each seed mixture for turfgrass hydroseeding
3. Certification of each seed mixture for turfgrass seeding

D. Qualification Data: For qualified landscape Installer.

E. Product certificates: For soil amendments and fertilizers, from manufacturer.

F. Soils tests, analysis and recommendations.

G. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

H. LEED Submittals:

Credit MR 5: REGIONALLY MANUFACTURED, HARVESTED/EXTRACTED/RECOVERED MATERIALS. Maximize use of building materials or products that have been mined, extracted, harvested or recovered as well as manufactured within a 500 miles of the project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally within 500 miles, then only that percentage (by weight) shall contribute to the regional value.

Mechanical, electrical and plumbing components and specialty items shall be excluded. Only materials permanently installed in the project from divisions 2-10 shall be included.

1. Product Certificates for Credit MR 5:

    a. LEED Material Submittal Form_2010 must be completed by all contractors indicating the product or material, manufacturer, cost of material only (minus tax, shipping, labor and overhead) and location of extraction/harvest/recovery and manufacturing location.
    b. In order to verify that the extraction, harvest, recovery and manufacture site is located within a 500 mile radius of the project site, project teams are required to indicate the actual mileage between the project site and the manufacturer and similarly, the distance between the project site and the extraction site for each raw material in the submittal template. ALTERNATIVELY, a statement on the manufacturer's letter head indicating that the point of extraction, harvest, recovery or manufacture is within 500 miles of the LEED project site, will also be accepted as part of the LEED documentation and credit submittals.
    c. Submittals will be rejected if any of the required fields on the LEED Submittal Sheets are incomplete.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years experience in turf installation in addition to requirements in Division 1 Section "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Landscape Industry Certified Technician – Exterior.
    b. Landscape Industry Certified Lawn Care Technician.

5. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent laboratory such as a state laboratory, commercial laboratory or university laboratory, recognized by the State, with the experience and capability to conduct the testing indicated and that specializes in the types of tests to be performed.

C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt,

and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. The soil-testing laboratory shall oversee soil sampling, with representative samples taken from varied locations for each soil to be used or amended for planting purposes. Perform soil tests for all soil to be used from both on-site and off-site sources.

2. Report suitability of tested soil for plant growth.

    a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

D. Preinstallaton Conference: conduct conference at Project Site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. Store packaged materials in a manner that will prevent damage or intrusion of foreign matter. Any material that becomes contaminated will be removed from the job site.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime and soil amendments with appropriate certificates.

1.8 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Seed

    a. Spring Planting: March 01 to May 15
    b. Fall Planting: August 15 to October 15

2. Sod

a. Spring Planting: March 01 to June 15
b. Fall Planting: August 15 to November 15

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions

1.9 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within the specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor’s control.
b. Structural failures including plantings falling or blowing over.

2. Warranty Periods from Date of Planting Completion:

a. Seeded Turf: 12 months, or completion of a single growing season, whichever is greater.
b. Sodded Turf: 12 months, or completion of a single growing season, whichever is greater.

1.10 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Seeded Turf: From date of installation to end of Warranty Period.
2. Sodded Turf: From date of installation to end of Warranty Period.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances. It shall be mixed in the proportion shown and test results certifying no more than .02% weed seed and 85% minimum germination. Approved varieties shall be selected from “Recommended Turfgrass cultivars for Professional Seed Mixtures,” University of Maryland Turfgrass Technical Update TT-77, most recent edition. A copy of this publication can be obtained by visiting the Maryland Turfgrass Council website http://www.mdturfcouncil.org or by calling them at 410-836-2876.

B. Seed Species: State-certified seed of grass species as follows:

1. Sun and Partial Shade: Proportioned by weight as follows:

   a. 80-95% Certified Tall Fescue
   b. 5-10% Certified Kentucky Bluegrass
   c. 0-10% Certified Perennial Ryegrass *

   *Note: The routine inclusion of perennial ryegrass is not recommended, but may be added to the mixture when the seeding site is at high risk for soil erosion or when cool temperatures may hinder establishment of tall fescue and Kentucky bluegrass. Two cultivars of tall fescue and one cultivar of Kentucky bluegrass may be used, but the inclusion of three or more tall fescue cultivars is recommended. The seeding rate of this mixture shall be 7.0 to 8.0 lbs. P.L.S. per 1000 ft^2.

2.2 TURFGRASS SOD

A. Turfgrass Sod: Maryland Certified (labeled), inspected and approved by the Maryland Department of Agriculture, complying with Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species:

1. Sod shall be a 90/10 mix with 90% of the mix consisting of a blend of at least three turf type tall fescues, and at least 10% Bluegrass. Approved varieties shall be selected “Recommended Turfgrass cultivars for Professional Seed Mixtures,” University of Maryland Turfgrass Technical Update TT-77 most recent edition. A copy of this publication can be obtained by visiting the Maryland Turfgrass Council website http://www.mdturfcouncil.org or by calling them at 410-836-2876.

   a. Thickness of Cut: The thickness of the roots and soil should be ½” to ¾”.
   b. Pad Size: Individual pieces of sod shall be cut to the supplier’s standard width and length. Maximum allowable deviation from standard widths and lengths shall be 5%. Broken pads and torn or uneven ends will not be acceptable.
   c. Strength of Sod Sections: Under ideal conditions, standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10% of the section **without the use of netting**. NOTE: Younger tall fescue will not be strong enough to pass this test but is still okay to use.
   d. Sod Viability: Sod shall not be harvested or transplanted under drought conditions.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
2. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content less than or equal to 30 percent by weight; 98 percent passing through 1-inch sieve; soluble salt content of less than 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.5 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.6 SUBSOILS

A. Subsoils shall contain a maximum volume of 25% of rocks or other materials larger than 0.25 inches in diameter, and shall contain no rocks or other materials larger than 5.0 inches in diameter. The depth of the subsoil layer that lies upon rock or other materials which do not themselves constitute subsoil shall be at least 6.0 inches deep. When the subsoil layer is less than 6.0 inches deep, either topsoil or additional subsoil shall be moved to the site and spread in a layer so that the base of subsoil upon which the final topsoil layer will be spread is at least 6.0 inches deep. Subsoils shall not contain any chemicals or other materials in concentrations which may be toxic to the growth of turfgrass seedlings.

B. Test subsoils for pH, soluble salts, phosphorus and potassium. Subsoils shall not have acidity below pH 5.5 or above pH 7.5. Subsoils with pH 6.5 is ideal. Subsoils shall not be deficient in phosphorus or potassium based on turfgrass requirements. If deficient, amend subsoils in accordance with recommendations obtained from the soil testing laboratory.

2.7 PLANTING SOILS

A. Planting Soils are amended existing stockpiled ASTM D 5268 topsoil, amended existing in-place soil, or amended soil from an off-site source that has been spread to finish grade, will support plant growth, and meets the following requirements. The soil shall closely match the mechanical analysis (percentage sand, silt and clay) of the existing subsoil. Soil shall be free of cinders, stones, slag, coarse fragments, gravel, sticks, trash, roots, plants, sod, clods, clay lumps, pockets of coarse sand and other debris over 3/4" in any dimension. Soil will be to a depth of 12” for landscape areas, 6” for lawn areas, and 18” for individual trees and shrubs. It must also be free of plants or plant parts of Bermuda grass, Quack grass, Johnson grass, Nutsedge, Poison Ivy, Phragmites, Canada thistle, or any noxious weeds. The soil shall contain no paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, or other substances harmful to plant growth. If the existing native subsoil is a bank run gravel, the topsoil or landscape bedding soil shall be a sandy loam.

B. Amend soils based on soil test results in accordance with soil testing lab recommendations for the type of plant material used in each respective planting area. Wherever practicable, Contractor shall amend native, on-site soils as required to create planting soils.

1. Soil for turf areas:

a. Topsoil shall be of a nature and quality sufficient to establish and support the growth of turfgrass. To a depth of 4.0 inches below the soil surface, topsoil shall contain a maximum volume of 15% of rocks or other stony material larger than 0.25 inches in diameter; no rocks or other stony material larger than 3/4 inches in diameter; a minimum organic matter content of 4.0%; and no soil sterilants, herbicides, or other materials harmful to germinating grasses.
b. The pH shall be between 6.0-7.0.

c. The acceptable amount of Magnesium shall be 35 pounds per acre; Phosphorus shall be 100 pounds per acre; Potassium shall be 85 pounds per acre, and Nitrogen shall be a minimum of 50 pounds per acre.
d. Soluble salts shall not exceed 3 mmhos/cm. Calcium levels shall not exceed 2000 parts per million.
e. Organic Matter shall be greater than four percent.

2. Soil for Landscaping areas

a. The pH shall be based on the specific plant requirements but will be within the range of 5.5-6.5.
b. The acceptable amount of Magnesium shall be 71-124 pounds per acre; Phosphorus shall be 62-102 pounds per acre; Potassium shall be 85-160 pounds per acre, and Nitrogen shall be a minimum of 50 pounds per acre.
c. Soluble salts shall not exceed 4mmhos/cm, Calcium levels shall not exceed 2,000 parts per million.
d. Organic Matter shall be greater than five percent.

2.8 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, bright, small grain type straw. Straw shall be free of rot and noxious weed seeds. Apply ½”- ¾” thick layer or 60-80 bales/acre.

B. Hydro mulch: Wood cellulose applied at a net dry weight of 750 pounds per acre. See LCA, Landscape Specification Guidelines, Seeding and Sodding specifications, Section 5.3 Mulching Materials, for detailed specifications.

2.9 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.10 HERBICIDES

A. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

B. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 SOIL TESTING

A. All soil testing shall be done at the Contractor’s expense. Soil tests shall be conducted by a state laboratory, university laboratory or recognized commercial laboratory. Each sample shall be extracted from a six-inch deep core and prepared in accordance with recommendations of the soil-testing laboratory.

B. Each soil test shall determine soil texture (mechanical analysis), pH, magnesium, phosphorus, potassium, soluble salts, total calcium, nitrogen, and percent organic matter. If the soil is sandy, it shall also be tested for boron. Soil test results shall include laboratory recommendations for soil amendments to correct deficiencies and accomplish planting objectives. Follow recommendation of Landscape Specification Guidelines, latest edition, Landscape Contractor's Association of Maryland, Virginia, and The District of Columbia, Seeding and Sodding Section for optimum plant growth and provide course of action based on their recommendation. The Contractor shall submit plans with the soil test results showing the locations of all soil tests. Incomplete test results and plans will be rejected, and shall be redone at the Contractor's expense.

C. For all new soils provided from off-site sources, obtain one soil test for each soil source per 500 cubic yards of soil and submit soil test results and soil amendment recommendations to Owner or Owner's representative for review and acceptance prior to distributing and amending soil.

D. For all existing stockpiled topsoil to be redistributed on site, obtain one soil test per 500 cubic yards of soil prior to application. Submit soil test results and soil amendment recommendations to Owner or Owner's representative for review and acceptance prior to redistributing and amending soil.

E. Where paving and base materials have been removed and the area is to be re-established with lawn or planting, obtain one composite soil test per 10,000 square feet of subsoil material, or at least one composite test for each separate excavated area. Each composite soil test shall consist of no less than five one-half cup samples taken at random from each sampling area. Each sample shall be taken from a six-inch deep core. The five or more samples shall be mixed together to form a composite sample, from which a pint sample shall be extracted, air-dried and tested. Submit soil test results and subsoil amendment recommendations to Owner or Owner's representative for review and approval subsoil amendment recommendations prior to filling the area with soil.

F. For existing soil to remain in place and be amended for landscape areas, submit one composite soil test for each isolated bed area (separated from other beds by paving). For existing soil to remain in place and be amended for lawn areas, submit one composite soil test per 20,000 square feet. Composite tests for planting areas shall be mixed from a minimum of five samples as described in E above. Composite tests for lawn areas shall be mixed from a minimum of ten samples as described in E above. Submit soil test results and soil amendment recommendations to Owner or Owner's representative for review prior to amending soil.

G. Following completion of soil amendment operations and fine grading, and prior to planting, 10 additional soil samples shall be taken at random from planting and lawn areas throughout the site. The Owner or Owner's representative shall determine locations of tests. These samples shall not be composite samples and are to assure that soils have been amended properly prior to planting or installation of lawn. Submit soil test results to Owner or Owner's representative for review. If it is apparent that soils have not been amended as specified or protected from contamination, areas not in compliance with specified requirements shall be reworked and retested as required until soils meet specified requirements. All rework and retesting shall be at the Contractor's expense.

3.2 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. All areas to receive planting soil shall be free of construction debris, refuse, compressible or decayable materials, stones greater than two inches and standing water.
3. Do not mix or place soils and soil amendments in frozen, excessively dry, wet, or muddy conditions.
4. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
5. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

3.3 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.4 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Subsoil areas which are intended to receive topsoil shall be maintained on a true and even grade, in compliance with plans, drawings or other applicable specifications pertaining to the site, with no significant depressions or elevations. Topsoil shall not be deposited or spread over the subsoil until rough grading has been completed and all areas within the subgrade are within 2/10 of 1.0 foot (2.5 inches per foot) from the final subgrade. If the graded area develops weed or other plant growth, the plants shall be eliminated before topsoil is deposited or spread over the subsoil.

C. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches by disking, tilling, or scarifying with rototillers, disk harrows, chisel plows, rippers, or other suitable soil preparation equipment. Incorporate recommended soil amendments into top 6” of subsoil. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Wherever suitable native on-site soil is available, contractor shall amend this soil to create planting soil.

2. Thoroughly blend planting soil before spreading or spread planting soil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.

a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
b. Mix lime with dry soil before mixing fertilizer.

3. Spread planting soil to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

a. Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.
b. Reduce elevation of planting soil to allow for soil thickness of sod.

D. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
2. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.

a. Apply fertilizer directly to surface soil before loosening.

3. Remove stones larger than ¾ inch in any dimension and sticks, roots, trash, brush, wire, grade stakes and other debris that would interfere with seeding and sodding.
4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

E. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

F. For soil preparation in critical root zone areas of existing trees, all work must be done by hand with shovels and rakes, unless otherwise approved in writing by the M-NCPPC inspector.

G. Planting may be done immediately thereafter, provided the topsoil has remained in a good, friable condition and has not become muddy or hard. If it has become hard, it shall be tilled to a friable condition again before acceptance. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

H. Before planting, obtain Owner or Owner’s representative acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.5 SEEDING

A. Seed shall be used within 9 months of its most recent germination test.

B. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.
2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

C. Sow seed at a total rate of 7 to 8 lb P.L.S./1000 sq. ft.

D. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

E. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

F. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.

G. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil, rolling thoroughly in several directions with suitable mechanical equipment.

H. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch and roll surface smooth.

3.6 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.7 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with biodegradable staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
3. On slopes greater than 1:3 or steeper staple sod at a minimum of 4 staples per square yard of sod.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.8 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow Fescue/Kentucky bluegrass to a height of 2 to 3 inches.

D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.9 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

C. Turf Grass Conditions will not be accepted if there is a poor or thin stand; improper application of sod, dead grass or sod, use of seed mixtures or sod other than approved in specifications, improper fertilizer application either uneven spreading or insufficient amounts, or failure to re-

fertilize during extended acceptance, and the presence of persistent weeds established in turf areas.

3.10 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after establishment period.

3.12 TEMPORARY SEEDING

A. Preparation:

1. Loosen top 2 inches of seedbed.
2. Apply lime and fertilizer at rates specified by soil testing laboratory.

B. Seed Application: Follow application for permanent seeding.

C. Mulch Application: Follow application for permanent mulching.

3.13 TIME RESTRICTIONS

A. When permanent seeding or sodding is specified or directed, and is not allowed because of time restrictions specified above, utilize one or more of following methods to prevent erosion and sedimentation until permanent seeding or sodding is allowed.

1. Place and anchor straw mulch or wood chips.
2. Apply temporary seeding and mulch.
3. Prepare soil as for permanent seeding and then mulch as specified herein; overseed during next seasonal seeding period.
4. Provide other erosion control measures acceptable to Engineer.
5. Remove straw or wood chips used as temporary mulch or work into subsoil minimum depth of 6 inches before initiation of permanent seeding or sodding application.

END OF SECTION 329200

SECTION 32 93 00

PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plants.
2. Planting soils.
3. Tree stabilization.

B. Related Sections:

1. Division 01 Section "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Division 31 Section "Site Clearing" for protection of existing trees and plantings, topsoil stripping and stockpiling, and site clearing.
3. Division 31 Section "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
4. Division 32 Section "Lawns Grasses and Meadows" for turf planting, hydroseeding, and erosion-control materials.

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

D. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

E. Finish Grade: Elevation of finished surface of planting soil.

F. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

G. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

H. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

I. Planting Area: Areas to be planted.

J. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

K. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

L. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

M. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

O. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

P. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including soils.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
3. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst

quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. Samples for Verification: For each of the following:

1. Organic Mulch: 1-pint volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
2. Mineral Mulch: 2 lb of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on the site; provide an accurate indication of color, texture, and makeup of the material.

C. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

D. Material Test Reports: For existing native surface topsoil and imported or manufactured topsoil.

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

F. LEED Submittals:

Credit MR 5: REGIONALLY MANUFACTURED, HARVESTED/EXTRACTED/RECOVERED MATERIALS. Maximize use of building materials or products that have been mined, extracted, harvested or recovered as well as manufactured within a 500 miles of the project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally within 500 miles, then only that percentage (by weight) shall contribute to the regional value.

Mechanical, electrical and plumbing components and specialty items shall be excluded. Only materials permanently installed in the project from divisions 2-10 shall be included.

1. Product Certificates for Credit MR 5:

   a. LEED Material Submittal Form_2010 must be completed by all contractors indicating the product or material, manufacturer, cost of material only (minus tax, shipping, labor and overhead) and location of extraction/harvest/recovery and manufacturing location.
   b. In order to verify that the extraction, harvest, recovery and manufacture site is located within a 500 mile radius of the project site, project teams are required to indicate the actual mileage between the project site and the manufacturer and similarly, the distance between the project site and the extraction site for each raw material in the submittal template. ALTERNATIVELY, a statement on the manufacturer’s letter head indicating that the point of extraction, harvest, recov-

ery or manufacture is within 500 miles of the LEED project site, will also be accepted as part of the LEED documentation and credit submittals.

c. Submittals will be rejected if any of the required fields on the LEED Submittal Sheets are incomplete.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in landscape installation in addition to requirements in Division 1 Section "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Certified Landscape Technician - Exterior, with installation or maintenance specialty area(s), designated CLT-Exterior.
    b. Certified Ornamental Landscape Professional, designated COLP.

5. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent laboratory such as a state laboratory, commercial laboratory or university laboratory, recognized by the State, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

A. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. The soil-testing laboratory shall oversee soil sampling, with representative samples taken from varied locations for each soil to be used or amended for planting purposes. Perform soil tests for all soil to be used from both on-site and off-site sources.
2. Report suitability of tested soil for plant growth.

    a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species,

variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

D. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable. Store packaged materials in a manner that will prevent damage or intrusion of foreign matter. Any material that becomes contaminated will be removed from the job site.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

F. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Do not remove container-grown stock from containers before time of planting.
2. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be

obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

C. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.8 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
b. Structural failures including plantings falling or blowing over.

2. Warranty Periods from Date of Planting Completion:

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months, or completion of a single complete growing season, whichever is greater.
b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months, or completion of a single complete growing season, whichever is greater.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

1. Maintenance Period for Trees and Shrubs: From date of installation to end of Warranty Period.
2. Maintenance Period for Ground Cover and Other Plants: From date of installation to end of Warranty Period.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

E. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

F. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
3. Provide lime in form of dolomitic limestone.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content less than or equal to 30 percent by weight; 98 percent passing through 1-inch sieve; soluble salt content of less than 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

F. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

2.5 SUBSOILS

A. Subsoils shall contain a maximum volume of 25% of rocks or other materials larger than 0.25 inches in diameter, and shall contain no rocks or other materials larger than 5.0 inches in diameter. The depth of the subsoil layer that lies upon rock or other materials which do not themselves constitute subsoil shall be at least 6.0 inches deep. When the subsoil layer is less than 6.0 inches deep, either topsoil or additional subsoil shall be moved to the site and spread in a layer so that the base of subsoil upon which the final topsoil layer will be spread is at least 6.0 inches deep. Subsoils shall not contain any chemicals or other materials in concentrations which may be toxic to the growth of plants.

B. Test subsoils for pH, soluble salts, phosphorus and potassium. Subsoils shall not have acidity below pH 5.5 or above pH 7.5. Subsoils with pH 6.5 is ideal. Subsoils shall not be deficient in phosphorus or potassium based on plants requirements. If deficient, amend subsoils in accordance with recommendations obtained from the soil testing laboratory.

2.6 PLANTING SOILS

A. Planting Soils are amended existing stockpiled ASTM D 5268 topsoil, amended existing in-place soil, or amended soil from an off-site source that has been spread to finish grade, will support plant growth, and meets the following requirements. The soil shall closely match the mechanical analysis (percentage sand, silt and clay) of the existing subsoil. Soil shall be free of cinders, stones, slag, coarse fragments, gravel, sticks, trash, roots, plants, sod, clods, clay lumps, pockets of coarse sand and other debris over 3/4" in any dimension. Soil will be to a depth of 12” for landscape areas, 6” for lawn areas, and 18” for individual trees and shrubs. It must also be free of plants or plant parts of Bermuda grass, Quack grass, Johnson grass, Nutsedge, Poison Ivy, Phragmites, Canada thistle, or any noxious weeds. The soil shall contain no paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, or other substances harmful to plant growth. If the existing native subsoil is a bank run gravel, the topsoil or landscape bedding soil shall be a sandy loam.

B. Amend soils based on soil test results in accordance with soil testing lab recommendations for the type of plant material used in each respective planting area. Wherever practicable, Contractor shall amend native, on-site soils as required to create planting soils.

1. Soil for Landscaping areas

    a. The pH shall be based on the specific plant requirements but will be within the range of 5.5-6.5.
    b. The acceptable amount of Magnesium shall be 71-124 pounds per acre; Phosphorus shall be 62-102 pounds per acre; Potassium shall be 85-160 pounds per acre, and Nitrogen shall be a minimum of 50 pounds per acre.
    c. Soluble salts shall not exceed 4mmhos/cm, Calcium levels shall not exceed 2,000 parts per million.
    d. Organic Matter shall be greater than five percent.

2.7 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood, well aged.
2. Color: Natural.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content less than or equal to 30 percent by weight; 98 percent passing through 1-inch sieve; soluble salt content of less than 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

2.8 PESTICIDES

A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.9 HERBICIDES

A. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

B. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.10 TREE STABILIZATION MATERIALS

A. Stakes and Guys:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
2. Tree-Tie Webbing: 3/4" - 1" wide woven UV-resistant polypropylene or nylon webbing straps.
3. Guy Cables: Five-strand, 3/16-inch-diameter, galvanized-steel cable, with zinc-coated turnbuckles, with two galvanized eyebolts.
4. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

PART 3 - EXECUTION

3.1 SOIL TESTING

A. All soil testing shall be done at the Contractor’s expense. Soil tests shall be conducted by a state laboratory, university laboratory or recognized commercial laboratory. Each sample shall be extracted from a six-inch deep core and prepared in accordance with recommendations of the soil-testing laboratory.

B. Each soil test shall determine soil texture (mechanical analysis), pH, magnesium, phosphorus, potassium, soluble salts, total calcium, nitrogen, and percent organic matter. If the soil is sandy, it shall also be tested for boron. Soil test results shall include laboratory recommendations for soil amendments to correct deficiencies and accomplish planting objectives. Follow recommendation of Landscape Specification Guidelines, latest edition, Landscape Contractor's Association of Maryland, Virginia for optimum plant growth and provide course of action based on their recommendation. The Contractor shall submit plans with the soil test results showing the locations of all soil tests. Incomplete test results and plans will be rejected, and shall be redone at the Contractor's expense.

C. For all new soils provided from off-site sources, obtain one soil test for each soil source per 500 cubic yards of soil and submit soil test results and soil amendment recommendations to Architect for review and acceptance prior to distributing and amending soil.

D. For all existing stockpiled topsoil to be redistributed on site, obtain one soil test per 500 cubic yards of soil prior to application. Submit soil test results and soil amendment recommendations to Architect for review and acceptance prior to redistributing and amending soil.

E. Where paving and base materials have been removed and the area is to be re-established with lawn or planting, obtain one composite soil test per 10,000 square feet of subsoil material, or at least one composite test for each separate excavated area. Each composite soil test shall consist of no less than five one-half cup samples taken at random from each sampling area. Each sample shall be taken from a six-inch deep core. The five or more samples shall be mixed together to form a composite sample, from which a pint sample shall be extracted, air-dried and tested. Submit soil test results and subsoil amendment recommendations to Architect for review and approval subsoil amendment recommendations prior to filling the area with soil.

F. For existing soil to remain in place and be amended for landscape areas, submit one composite soil test for each isolated bed area (separated from other beds by paving). For existing soil to remain in place and be amended for lawn areas, submit one composite soil test per 20,000 square feet. Composite tests for planting areas shall be mixed from a minimum of five samples as described in E above. Composite tests for lawn areas shall be mixed from a minimum of ten samples as described in E above. Submit soil test results and soil amendment recommendations to Architect for review prior to amending soil.

G. Following completion of soil amendment operations and fine grading, and prior to planting, 10 additional soil samples shall be taken at random from planting and lawn areas throughout the site. The Architect shall determine locations of tests. These samples shall not be composite samples and are to assure that soils have been amended properly prior to planting or installation of planting and lawn. Submit soil test results to Architect for review. If it is apparent that soils have not been amended as specified or protected from contamination, areas not in compliance with specified requirements shall be reworked and retested as required until soils meet specified requirements. All rework and retesting shall be at the Contractor's expense.

3.2 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.3 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

3.4 PLANTING AREA ESTABLISHMENT

A. Subsoil areas which are intended to receive topsoil shall be maintained on a true and even grade, in compliance with plans, drawings or other applicable specifications pertaining to the site, with no significant depressions or elevations. Topsoil shall not be deposited or spread over the subsoil until rough grading has been completed and all areas within the subgrade are within 2/10 of 1.0 foot (2.5 inches per foot) from the final subgrade. If the graded area develops weed or other plant growth, the plants shall be eliminated before topsoil is deposited or spread over the subsoil.

B. Loosen subgrade of planting areas to a minimum depth of 6 inches by disking, tilling, or scarifying with rototillers, disk harrows, chisel plows, rippers, or other suitable soil preparation equipment. Incorporate recommended soil amendments into top 6” of subsoil. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Smithsonian's property.

1. Wherever suitable native on-site soil is available, contractor shall amend this soil to create planting soil.
2. Thoroughly blend planting soil before spreading or spread planting soil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
3. Spread planting soil to a depth of 12 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

D. For soil preparation in critical root zone areas of existing trees, all work must be done by hand with shovels and rakes, unless otherwise approved in writing by the Architect.

E. Planting may be done immediately thereafter, provided the topsoil has remained in a good, friable condition and has not become muddy or hard. If it has become hard, it shall be tilled to a friable condition again before acceptance. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, obtain Smithsonian or Smithsonian's representative acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.5 PLANTING SEASONS

A. September 1 to June 15, whenever soil is not frozen or excessively wet. Do not plant oaks during fall.

3.6 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

1. Excavate approximately three times as wide as ball diameter.
2. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
3. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.

B. Unamended subsoil removed from excavations may not be used as planting soil.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

3.7 TREE, SHRUB, AND VINE PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Set stock plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Use amended planting soil for backfill.

2. Balled and Burlapped: After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Container-Grown: Carefully remove root ball from container without damaging root ball or plant.
4. Fabric Bag-Grown Stock: Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
5. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
6. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
7. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.8 MECHANIZED TREE SPADE PLANTING

A. Trees shall be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.

B. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.

C. Cut exposed roots cleanly during transplanting operations.

D. Use the same tree spade to excavate the planting hole as was used to extract and transport the tree.

E. Plant trees as shown on Drawings, following procedures in "Tree, Shrub, and Vine Planting" Article.

F. Where possible, orient the tree in the same direction as in its original location.

3.9 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not

cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

C. Do not apply pruning paint to wounds.

3.10 TREE STABILIZATION

A. Install trunk stabilization as follows unless otherwise indicated:

1. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend at least one-third of trunk height above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
2. Support trees with tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

B. Staking and Guying: Stake and guy trees more than 14 feet in height and more than 5 inches in caliper unless otherwise indicated. Securely attach no fewer than three guys to stakes 30 inches long, driven to grade.

1. Site-Fabricated Staking-and-Guying Method:

a. For trees more than 6 inches in caliper, anchor guys to duckbills buried at least 36 inches below grade. Provide turnbuckle for each guy cable and tighten securely.
b. Support trees less than 6 inches caliper with tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
c. Support trees more than 6 inches in caliper with strands of cable, connected to the brass grommets of tree-tie webbing at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.
d. Attach flags to each guy webbing/cable, 30 inches above finish grade.

3.11 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated in even rows with triangular spacing.

B. Use amended planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.12 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees and Tree-like Shrubs in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with 24-inch radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.
2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.13 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use practices to minimize the use of pesticides and reduce hazards.

D. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.14 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.15 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

3.16 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 329300

SECTION 32 97 00

VEGETATED ROOF ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Continuous vegetated roof assemblies.

B. Related Requirements:

1. Section 07 54 23 "Thermoplastic Polyoelfin (TPO) Roofing" for roofing membrane, roof thermal insulation, aggregate or roof-paver ballast, and roofing system warranty.
2. Section 22 14 13 “Storm Water Piping” for roof drains.

1.3 DEFINITIONS

A. Captured Water: Water that is retained in the drainage layer of a vegetated roof assembly after new water additions have ceased and that cannot escape the roof except through evaporation or plant transpiration.

B. Finish Elevation: Elevation of finished growing-media surface of planting area.

C. Planting Area: Areas to be planted.

D. Plant; Plants; Plant Material: Vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

E. Growing Medium: Manufactured, lightweight soil mixture that promotes good growing conditions for specific varieties of plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site to review methods and procedures related to waterproofing and green roofing system, including schedule for waterproofing, flood testing, installation of soil media and planting schedule. Pre installation conference should include general contractors plan for green roof protection.

1. Review structural load limitations of roof deck during and after roofing.
2. Review flashing, special, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.

3. Review regulations and requirements of authorities having jurisdiction for insurance, certifications, and inspection and testing, if applicable.
4. Review temporary protection requirements for roofing system during and after installation.
5. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each vegetated roof assembly.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include material descriptions for each growing medium.
3. For products having recycled content, indicate percentages by weight of postconsumer and preconsumer recycled content.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer**.**

B. Product Certificates: For each type of manufactured product.

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory, according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Product Test Reports: For complete analysis of each growing medium, for tests performed by manufacturer and witnessed by a qualified testing agency or by a qualified testing agency.

D. Sample Warranty: For special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For vegetated roof assembly and plants, including a recommended maintenance plan with procedures for inspection and care during a calendar year. Submit before start of required warranty and maintenance periods.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified vegetated roof assembly Installer, approved, authorized, or licensed by roofing-membrane manufacturer, whose work has resulted in successful establishment of vegetated roofs.

B. Supplier Qualifications

1. Vegetated Green Plant supplier that specializes in the propagation of greenroof plants.
2. Vegetated Green Roof plant supplier must have with 5 years experience in the production and maintenance of green roof plants specifically chosen.
3. Engineered planting media by a firm that specifically mixes roof top media and is approved by plant supplier.

C. Contractor Qualifications

1. Contractor shall have successfully installed a green roof project where contractor performed all waterproofing, soil and planting with their own forces.
2. Contractor shall have a dedicated service department that will be willing to provide continued service for the vegetated green roof which will not be limited to weeding, fertilizing and additional plant installation as required.
3. Contractor shall have been in business for 10 years specializing in commercial waterproofing and roofing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials on or near structures, utilities, walkways and pavements, or existing roof areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of debris-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with product certificates.

C. Handle and store materials, and place equipment in a manner to avoid overloading roof structure or damaging roofing membrane.

1.10 FIELD CONDITIONS

A. Weather Limitations: Apply vegetated green roofing components within the range of ambient and substrate temperature recommended by roofing system manufacturer. Do not apply vegetated green roof components to a damp or wet substrate or when temperature is below 45ºF.

1. Do not install plants during winter months.
2. Plants will be cared for following plant growers recommendations, if planting occurs during mid summer additional watering maybe required.

1.11 WARRANTY

A. Special Warranty for Vegetated Roof Assembly: Installer agrees to repair or replace components of vegetated roof assembly that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, ponding water or prolonged wetness of growing medium caused as a result of failure of the assembly to properly drain.
2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Warranty for Plant Growth: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Foliage Cover: Planted materials shall grow to achieve and maintain at least 80 percent foliage cover over planting area commencing 24 months after planting, through the duration of this warranty.
2. Failures include, but are not limited to, death and unsatisfactory growth except for defects resulting from abuse, lack of adequate maintenance, neglect by Owner, or incidents that are beyond Contractor's control.
3. Warranty Period: From date of Substantial Completion as follows:

    a. Green Roof Plants: Two (2) years.

4. Include the following remedial actions as a minimum:

    a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
    b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
    c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.

5. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain vegetated roof assembly components from single source from single manufacturer.

2.2 VEGETATED ROOF ASSEMBLIES

A. Continuous Vegetated Roof Assembly: Continuous-coverage assembly consisting of manufacturer's standard vegetated roof assembly components for installation over roofing system.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Firestone Skyscape Extensive System or comparable product by one of the following:

    a. American Hydrotech, Inc.
    b. Barrett Company.
    c. Carlisle SynTec Incorporated.
    d. Henry Company.

2. Assembly Depth, Nominal: As indicated on Drawings.
3. Plantings: As indicated on Drawings..

2.3 VEGETATED ROOF ASSEMBLY COMPONENTS

A. Drainage Panels: Assembly manufacturer's standard drainage board formed from geotextile-faced, molded-plastic sheet with a geotextile face and "cups" of the molded sheet facing upward like small reservoirs to retain water while allowing excess water to drain away below the board.

B. Recycled Content: drainage panels shall have postconsumer recycled content plus one-half of preconsumer recycled content not less than 40 percent by weight.

2.4 MANUFACTURED GROWING MEDIA

A. Growing Medium: Vegetated roof assembly manufacturer's lightweight, manufactured soil mixture designed for plants indicated on Drawings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Firestone SkyScape Growing Media or comparable product by one of the following:

a. Midwest Trading Horticultural Supplies.
b. Skyland USA.
c. Stancills, Inc.
d. WeCare Organics LLC.

2. General Condition at Time of Planting: Free of aggregates 1/2 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of weeds and other botanical pests; not infested with nematodes, grubs, or other pests or pest eggs; free of disease-causing plant pathogens and other undesirable organisms; friable and with sufficient structure to give good tilth and aeration.
3. Maximum Media Density: ASTM E 2399, 82 lb/cu. ft. for basic growing-medium mixture.
4. Water Permeability: ASTM E 2434, 40 in/hr for basic growing-medium mixture at maximum media density.
5. Organic Material Content: ASTM F 1647, Method A, organic material as measured using the loss-on-ignition procedure.

a. Minimum: 4 percent.

6. Chemical Properties:

a. Growing-Medium pH (Reaction): 6.0 to 7.0.

2.5 ACCESSORIES

A. Protection Board: As recommended by roofing-membrane manufacturer.

B. Soil Retainer: Vegetated roof assembly manufacturer's extruded-aluminum edging with drainage openings.

1. Configuration: L-shaped.
2. Color: Mill-finish metal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine each area to receive vegetated roof assembly for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Verify that roof insulation over roofing membrane is in place, secure, and flush along all seams.
2. Verify that perimeter and other flashings are in place and secure along entire lengths where they will be covered by vegetated roof assembly.

B. Inspect growing medium.

1. Verify that no foreign or deleterious material or liquid, such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in growing medium within a planting area.
2. If growing medium is contaminated by foreign or deleterious material or liquid, remove growing medium and contamination and replace with new growing medium.

3.2 INSTALLATION, GENERAL

A. Protection Course: Cover roofing system with protection board with butted and fully taped joints before roofing system is subject to vegetated roof assembly installation work.

B. Install vegetated roof assembly according to manufacturer's written instructions.

C. Small Plant Stabilization: Install erosion-control fabric over planting area to secure small plants according to manufacturer's written instructions.

3.3 PLANTING

A. Perform planting according to vegetated roof assembly manufacturer's written instructions.

B. Do not place growing medium or plants during frozen, wet, or muddy conditions.

C. Suspend spreading, grading, and planting operations during periods of excessive moisture until the moisture content in growing medium reaches acceptable levels to attain the required results.

D. Uniformly moisten an excessively dry growing medium that is too dusty or unworkable.

E. Site Planting: Plant vegetated roofs according to requirements specified in Section 32 92 00 "Lawns Grasses and Meadows" and Section 32 93 00 "Plants" except as otherwise indicated on Drawings and required by vegetated roof assembly manufacturer's written instructions. Perform digging carefully to prevent damaging roofing system below the vegetated roof assembly.

F. Plugging: Plant plugs in holes or furrows, spaced 12 inches apart in both directions.

G. Individual Plant Planting: Set out and space plants other than grasses and wildflowers as indicated on Drawings in even rows with triangular spacing.

1. Dig holes large enough to allow spreading of roots.
2. Water thoroughly after planting, taking care not to cover plant crowns with wet growing medium.
3. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.4 SOIL-RETAINER INSTALLATION

A. Install soil retainer where indicated according to manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage roofing-membrane manufacturer's authorized service representative to provide inspection of vegetated roof assembly installation and prepare inspection reports.

B. Correct deficiencies in work that do not comply with requirements.

C. Prepare inspection reports.

3.6 PROTECTION

A. Protect vegetated roof assemblies from damage, including growing-medium contamination, due to operations of other contractors and trades. Repair or replace damaged vegetated roof assemblies.

3.7 MAINTENANCE SERVICE

A. Maintenance Service: Provide maintenance by skilled employees of vegetated roof assembly Installer. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than the specified maintenance period.

1. Assembly and Plant Maintenance: During maintenance period, maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing devices, resetting plants to proper elevations or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

    a. Replace growing medium that becomes displaced or eroded because of settling or other processes.
    b. Apply treatments as required to keep plant materials, planted areas, and growing medium free of pests and pathogens or disease. Use integrated past management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.
    c. Use only products and methods acceptable to roofing-membrane manufacturer.

2. Maintenance Period: 12 months from date of Substantial Completion.

END OF SECTION 32 97 00

DIVISION 33 – UTILITIES

SECTION 334100

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure transition couplings.
3. Expansion joints and deflection fittings.
4. Cleanouts.
5. Drains.
6. Manholes.
7. Catch basins.
8. Stormwater quality and detention structures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins, stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.
3. Stormwater quality and detention structures: Include plans, elevations, sections, details, frames, covers and concrete design-mix reports.

    a. The contractor who is awarded the project is required to procure and submit for review of shop drawings for the underground stormwater structures and piping during the post-award period prior to execution of the contract. The county stipulates if for any reason the contract is not executed, the contractor will be reimbursed for the cost of preparation of these shop drawings. The contractor shall be prepared to install these storm water devices within 35 calendars days of date of notice to proceed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than 7 days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, SCH40, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.2 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.

1. Bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets
2. Class IV, Wall B.

2.3 CLEANOUTS

A. Plastic Cleanouts:

1. Basis-of-Design Product: Comparable product by one of the following:

a. Canplas LLC.
b. IPS Corporation.
c. NDS Inc.
d. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
e. Sioux Chief Manufacturing Company, Inc.
f. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group.

2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.4 DRAINS

A. Cast-Iron Area Drains:

1. Basis-of-Design Product: Provide product indicated on Drawings.

B. Cast-Iron Trench Drains:

1. Basis-of-Design Product: Provide product indicated on Drawings.

2.5 MANHOLES

A. Standard Precast Concrete Manholes:

1. See contract drawings.

B. Manhole Frames and Covers:

1. See contract drawings.

2.6 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

a. Invert Slope 2 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.7 CATCH BASINS

A. Basis of Design Product: Provide product indicated on drawings.

B. Frames and Grates: Provide product indicated on drawings.

2.8 STORMWATER INLETS

A. Gutter Inlets: Provide product indicated on drawings.

B. Frames and Grates: Heavy duty.

2.9 STORMWATER DETENTION STRUCTURES

A. Provide product indicated on drawings.

B. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping minimum cover as indicated on drawings.
3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
4. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
2. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

3. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts invehicle-traffic service areas.

B. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use Medium-Duty, top-loading classification drains in paved foot-traffic areas.

B. Embed drains in 4-inch minimum concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

E. Assemble trench sections with flanged joints.

F. Embed trench sections in 4-inch minimum concrete around bottom and sides.

3.6 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.7 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.8 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.9 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 221413 "Facility Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.

1. Make branch connections from side into underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

2. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. Connect to sediment interceptors specified in Section 221323 "Sanitary Waste Interceptors."

3.10 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
3. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Gravity-Flow Storm Drainage Piping: Test according to the following:

a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
b. Option: Test plastic piping according to ASTM F 1417.
c. Option: Test concrete piping according to ASTM C 924.

C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials Flush with potable water.

END OF SECTION 334100