



Hahnville Branch Library

15090 River Road
Hahnville, LA 70057

100% Construction Documents Specifications

Date: April 17, 2026
Grace Project #: 4024101

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00 00 02 – PROJECT DIRECTORY

Owner:

St. Charles Parish Library
160 West Campus Drive
PO Box 1029, Destrehan, LA 70047

Architect:

Grace Design Studios, LLC
601 Poydras Street, Ste 2310
New Orleans, LA 70130
p. 504.522.2050

Structural Engineer:

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1515 Poydras St Ste. 1020
New Orleans, LA 70112
p. 504.500.9640

Mechanical Engineer:

Huseman & Associates
3501 N. Causeway Blvd. #710
Metairie, LA 70002
p. 504.456.3119

Electrical Engineer:

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3501 N. Causeway Blvd. #710
Metairie, LA 70002
p. 504.456.3119

Civil Engineer:

Fox-Nesbit Engineering, LLC
1515 Poydras St Ste. 1020
New Orleans, LA 70112
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SECTION 00 0003 – PROFESSIONAL SEALS

ARCHITECT	STRUCTURAL ENGINEER	MECHANICAL ENGINEER
ELECTRICAL ENGINEER	CIVIL ENGINEER	

SECTION 00 0005 – INSTRUCTIONS TO BIDDERS

1.01 BIDDING DOCUMENTS

- A. The Bidding Documents include the following:
 - 1. Instructions to Bidders
 - 2. Bid Form
 - 3. Bid Bond
 - 4. General Conditions of the Contract for Construction
 - 5. Special Conditions
 - 6. Contract Between Owner and Contractor - AIA Document A101, available from Architect upon request.
 - 7. Performance Bond - Refer to specification section Special Conditions
 - 8. Payment Bond - Refer to specification section Special Conditions
 - 9. Specifications & Drawings
 - 10. Addenda issued during the bid period and acknowledged in the Bid Form
- B. All definitions set forth in the General Conditions of the Contract for Construction, or in other Contract Documents are applicable to the Bidding Documents.
- C. Addenda are written and/or graphic instruments issued by the Architect prior to the opening of bids which modify or interpret the Bidding Documents by additions, deletions, clarifications, corrections and prior approvals.
- D. A bid is a complete and properly signed proposal to do the work or designated portion thereof for the sums stipulated therein supported by data called for by the Bidding Documents.
- E. Base bid is the sum stated in the bid for which the Bidder offers to perform the work described as the base, to which work may be added, or deleted for sums stated in alternate bids.
- F. An alternate bid (or alternate) is an amount stated in the bid to be added (if an Additive Alternate), or deducted (if an Deductive Alternate) to the amount of the base bid if the corresponding change in project scope or materials or methods of construction described in the Bidding Documents is accepted.
- G. A Bidder is one who submits a bid for a prime Contract with the Owner for the work described in the proposed Contract Documents.
- H. A Sub-bidder is one who submits a bid to a Bidder for materials and/or labor for a portion of the work.
- I. Where the word "Architect" is used in any of the documents, it shall refer to the Prime Designer of the project, regardless of discipline.

1.02 ACCESS TO BIDDING DOCUMENTS

- A. Complete Bid Documents for this project are available in electronic form. They may be obtained without charge and without deposit by visiting the public projects area at Centerline Bid Connect www.centerlinebidconnect.com. Printed copies are not available from the Designer, but arrangements can be made to obtain them through most reprographic firms. Please note that Plan holders are responsible for their own reproduction costs. Questions about this procedure shall be directed to:
 - 1. Centerline Support Email: support@centerline.co
- B. Bidding documents are also available at wearescpps.org under "Resources," select "Online Bids, RFP's, etc."
- C. All plan holders are responsible for their own reproduction costs. No reproduction costs will be refunded.
- D. Complete sets of Bidding Documents shall be used in preparing bids; neither the Owner nor the Architect assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

- E. The Owner or Architect in making copies of the Bidding Documents available on the above terms, do so only for the purpose of obtaining bids on the work and do not confer a license or grant for any other use.

1.03 INTERPRETATION OF THE BIDDING DOCUMENTS

- A. Bidders shall promptly notify the Architect thru Centerline, www.centerlinebidconnect.com of any discrepancy, ambiguity, inconsistency, or error which they may discover upon examination of the Bidding Documents or of the site and local conditions. Failure to notify the Architect thru Centerline of any discrepancy, ambiguity, inconsistency, or error upon discovery of the item shall cause the bidder to be bound by the interpretation of the Architect in regards to the discrepancy, ambiguity, inconsistency or error.
- B. Prospective bidders desiring further information or interpretations of the Drawings and/or Specifications must request such data from the Architect electronically via Centerline, www.centerlinebidconnect.com . Answers to all questions, inquiries and requests for additional information will be issued in the form of Addenda to the Drawings and Specifications and copies of each addendum will be posted on Centerline www.centerlinebidconnect.com to all prospective bidders. Every request for such interpretation should be submitted electronically via Centerline. To be given consideration, requests must be RECEIVED at least seven (7) days prior to date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the Specifications and/or Drawings.
- C. Refer to Specification Section 00 0016b How to enter Request for Information (RFI) and Substitution Requests from bidding side.
- D. Any interpretation, correction or change of the Bidding Documents will be made by addendum. Interpretations, corrections or changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections and changes.

1.04 SUBSTITUTIONS

- A. The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. No substitutions shall be allowed after bidding.
- B. Where a single manufacturer or trade name appears in these Specifications, and / or the words "or equal" follow, it is the intent of these specifications that products of equal quality which meet the Architect's approval may be used. The brand, make or manufacturer listed describes the general style, type, character and quality of product desired.
- C. Requests for approval of substitute materials of equal quality and performance to those specified shall be RECEIVED by the Architect electronically via Centerline, www.centerlinebidconnect.com no later than seven (7) days before the date set for the opening of bids.
- D. No substitution will be considered unless written request for approval has been submitted by the Proposer and has been received by the Architect at least seven (7) working days prior to the date for receipt of bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including model numbers, drawings, cuts, performance and test data and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment or work that incorporation of the substitute would require shall be included. It shall be the responsibility of the proposer to include in his proposal all changes required of the Contract Documents if the proposed product is used. Prior approval is given contingent upon supplier being responsible for any costs which may be necessary to modify the space or facilities needed to accommodate the materials and equipment approved.
- E. If the Architect approves any proposed substitution, such approval will be set forth in an addendum. Bidders shall not rely upon approvals made in any other manner.

1.05 ADDENDA

- A. Addenda will be posted electronically on Centerline, www.centerlinebidconnect.com. All bidders registered on Centerline and attached to the project shall receive notice of each addendum and will be able to view, download or send it to printer.
- B. Additional copies of addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.
- C. Each Bidder shall ascertain from the Architect prior to submitting his bid that he has received all addenda issued, and he shall acknowledge their receipt on the Bid Form.

1.06 BID SUBMISSION

- A. Deliver written bids to the address indicated on the Invitation for Bids, prior to the time and date for submission indicated on the Invitation for Bids. Any bid received after the time and date indicated shall be disqualified. The bid form and all documents required to accompany the bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the bids, and shall be identified by the Project Name, the Bidder's name, address the Bidders state contractor's license number, and the notation "SEALED BID ENCLOSED".
- B. All blanks on the Bid Form shall be filled in by typewriter or manually in ink.
- C. Bid sums shall be expressed in both words and figures, and in case of discrepancy between the two, the written words shall govern.
- D. Any interlineation, alteration or erasure must be initialed by the signer of the bid or his authorized representative.
- E. Bidders are cautioned to complete all alternates should such be required in the Bid Form. Failure to submit alternate prices will render the proposal informal and shall cause its rejection.
- F. Bidder shall make no additional stipulations on the Bid Form nor qualify his bid in any other manner.
- G. The bid shall include the legal name of Bidder and shall be signed by the person or persons legally authorized to bind the Bidder to a Contract.
- H. The authority of the signature of the person submitting the bid shall be deemed sufficient and acceptable under any of the following conditions:
 - 1. Signature on bid is that of authorized representative of corporation, partnership, or other legal entity and bid is accompanied by corporate resolution, certification as to the corporate principal, or other documents, (written evidence), indicating authority.
- I. On any bid in excess of fifty thousand dollars (\$50,000.00), the Contractor shall be licensed under R.S. 37: 2150-2173 and show his license number on the bid above his signature or his duly authorized representative. Placement of the signature on the bid shall serve as certification of licensure.
- J. Bidders shall include a list of sub-contractors and vendors with their bid submission for the Owner's information.

1.07 LAWS AND REGULATIONS:

- A. All laws, ordinances, and rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout and they shall be deemed to be included in the Contract the same as though herein written out in full.

1.08 BIDDER'S REPRESENTATION:

- A. Each Bidder by making his bid represents that:
 - 1. He has read and understands the Bidding Documents and his bid is made in accordance therewith.
 - 2. He has visited the site and has familiarized himself with the local conditions under which the work is to be performed. No compensation shall be allowed for items of cost due to the contractor's lack of knowledge of existing conditions resulting in additional cost not included in the bid.

3. Should conditions be encountered below the natural grade which are not normally encountered and which could not be anticipated from visiting the site or from information available in the contract documents, the contractor may negotiate for additional cost as stipulated in the General Conditions of these Specifications.
4. His bid is based solely upon the materials, systems and equipment described in the Bidding Documents and as modified by addenda, and shall cover all applicable regulatory fees, building permit fees, tap fees, etc., all fees not specifically noted in the contract documents as by Owner.
5. His bid is not based on any verbal instructions contrary to the Contract Documents and addenda.
6. The Bidder must be fully qualified under any State or local licensing law for Contractors in effect at the time and at the location of the work before submitting his bid. In the State of Louisiana, Revised Statutes 37:2150, et seq. will be considered, if applicable.
7. The Contractor shall be responsible for determining that all of his Sub-bidders or prospective Subcontractors are duly licensed in accordance with law.

1.09 CONSIDERATION OF BIDS:

- A. The bids received on time will be opened privately, and a tabulation abstract of the amounts of the base bids and alternates, if any, will be made available to Bidders.

1.10 PRE-BID CONFERENCE:

- A. **A PRE-BID CONFERENCE will be held at _____, (Address) on (Month) (Day), 2025, at 2:00 p.m. Attendance at this pre-bid conference is Mandatory.** The purpose of the mandatory Pre-Bid Conference is to familiarize interested Bidders with the requirements of the Project and the intent of the Contract Documents, and to receive comments and information from interested Bidders.
- B. Any revision of the Bidding Documents made as a result of the Pre-Bid Conference shall not be valid unless included in an addendum.

1.11 ACCEPTANCE OF OFFER

- A. Owner reserves the right to accept or reject any or all offers.

1.12 POST-BID INFORMATION

- A. Submissions
- B. Prior to the submittal of the first Application for Payment, the Contractor shall submit the following information to the Architect.
 1. A designation of the work to be performed by the Contractor with his own forces.
 2. A breakdown of the Contract cost attributable to each item listed in the Schedule of Values Form (attached). No payments will be made to the Contractor until this is received.
 3. The proprietary names and the suppliers of principal items or systems of material and equipment proposed for the work.
 4. A list of names and business domiciles of all Subcontractors, manufacturers, suppliers or other persons or organizations (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the work. It is the preference of the Owner that, to the greatest extent possible or practical, the Contractor utilize Louisiana Subcontractors, manufacturers, suppliers and labor.
- C. The Contractor will be required to establish to the satisfaction of the Architect the reliability and responsibility of the proposed Subcontractors to furnish and perform the work described in the sections of the Specifications pertaining to such proposed Subcontractor's respective trades. The General Contractor shall be responsible for actions or inactions of Subcontractors and/or material suppliers.
- D. The General Contractor is totally responsible for any lost time or extra expense incurred due to a Subcontractor's/or Material Supplier's failure to perform. Failure to perform includes, but is not limited to, a Subcontractor's financial failure, abandonment of the project, failure to make prompt delivery, or failure to do work up to standard. Under no circumstances shall the Owner

mitigate the General Contractor's losses or reimburse the General Contractor for losses caused by these events.

- E. Subcontractors and other persons and organizations selected by the Bidder must be used on the work for which they were proposed and shall not be changed except with the written approval of the Owner and the Architect.

1.13 CONTRACT, NOTICE OF AWARD

- A. **Bond Requirements: Refer to Specification Section 00 0006, Supplementary Instructions to Bidders.**
- B. The Architect shall issue a Notice of Award, (signed by the Owner), to the Contractor with three original Owner / Contractor contracts, to allow the acquisition insurance certificates by the Contractor. The Contractor shall have 15 calendar day to deliver the signed contract, and Insurance Certificates to the Architect.
- C. The Bidder shall require the Attorney-in-Fact who executes the required bond on behalf of the surety to affix thereto a certified and current copy of his power of Attorney.

1.14 INSURANCE REQUIREMENTS:

- A. **Refer to Specification Section 00 0015 Contractor Contractual and Insurance Requirements.**

1.15 RELATED DOCUMENTS

- A. Document 00 0007 – Bid Form.
- B. Document 00 0011 - General Conditions of the Contract for Construction

END OF SECTION

SECTION 00 0018 – FEMA FIRMETTE WITH FLOOD ZONE DETERMINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. FEMA FIRMette with Flood Zone Determination for the proposed Hahnville Branch Library located at 15090 River Road, Hahnville, LA 70057.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A

No base flood elevations determined.

ZONE AE

Base flood elevations determined.

ZONE AH

Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO

Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined; for areas of alluvial fan flooding, velocities also determined.

ZONE A99

To be protected from 100-year flood by federal flood protection system under construction; no base flood elevations determined.

ZONE V

Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE

Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X

Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X

Areas determined to be outside 500-year floodplain.

ZONE D

Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS†

Identified 1983

Identified 1990

Otherwise Protected Areas

†Coastal barrier areas are normally located within or adjacent to special flood hazard areas.

Floodplain Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

Base Flood Elevation Line; Elevation in Feet*

513

Cross Section Line

(EL 987)

Base Flood Elevation in Feet Where Uniform Within Zone*

RM 7x

Elevation Reference Mark

•M1.5

River Mile

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for possible updated flood hazard information prior to use of this map for property purchase or construction purposes.

Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of special flood hazard (100-year flood) include Zones A, AE, AH, AO, A99, V, and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

Elevation reference marks are described in the Flood Insurance Study Report. For description of elevation reference marks, see panel 220160 0250.

For adjoining map panels see separately printed Map Index.

MAP REPOSITORY

St. Charles Parish Courthouse, Planning and Zoning Department, Hahnville, Louisiana 70057 (Maps available for reference only, not for distribution).

INITIAL IDENTIFICATION:

NOVEMBER 1, 1974

FLOOD HAZARD BOUNDARY MAP REVISIONS:

JUNE 28, 1977

FLOOD INSURANCE RATE MAP EFFECTIVE:

MAY 2, 1983

FLOOD INSURANCE RATE MAP REVISIONS:

June 16, 1992 - to change base flood elevations, to delete special flood hazard areas and to update map format.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE

2000 0 2000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

ST. CHARLES PARISH,
LOUISIANA
(UNINCORPORATED AREAS)

PANEL 125 OF 275
(SEE MAP INDEX FOR PANELS NOT PRINTED)

PANEL LOCATION

COMMUNITY-PANEL NUMBER

220160 0125 C

MAP REVISED:

JUNE 16, 1992

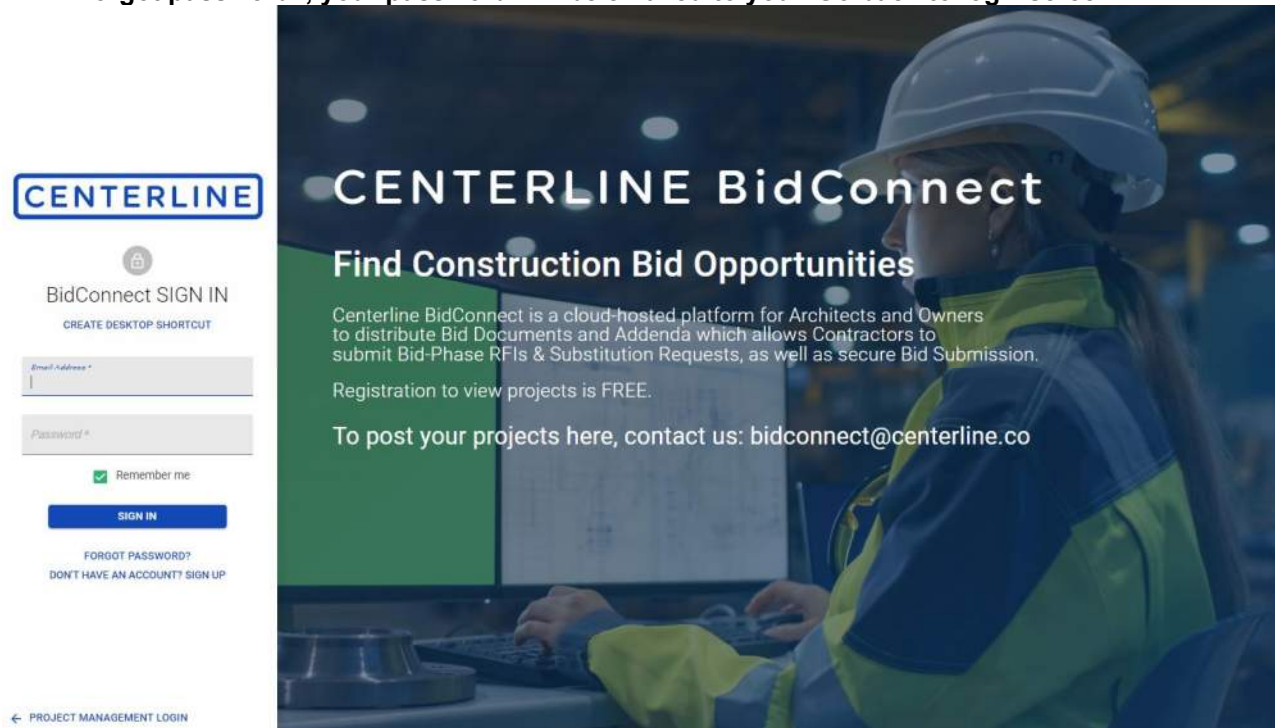
Federal Emergency Management Agency

SECTION 00 0005a - HOW TO ACCESS BIDDING DOCUMENTS - PLAN HOLDER'S LIST

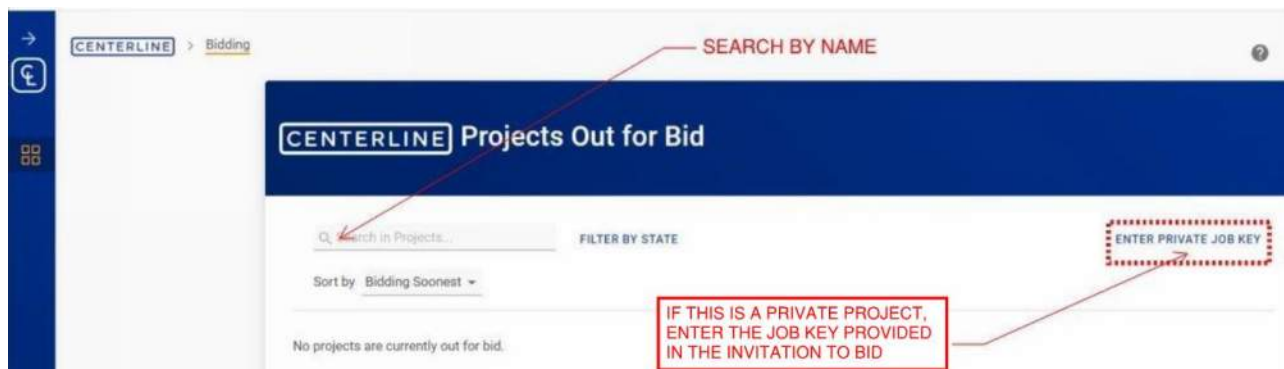
1. Go to the following site:
www.centerlinebidconnect.com

If this is your first time to Centerline's bidding module, you will need to go to "Don't have an account? Sign Up" and fill out the form and your password will be emailed to you, then continue with instructions. Sign up if you are a first time user.

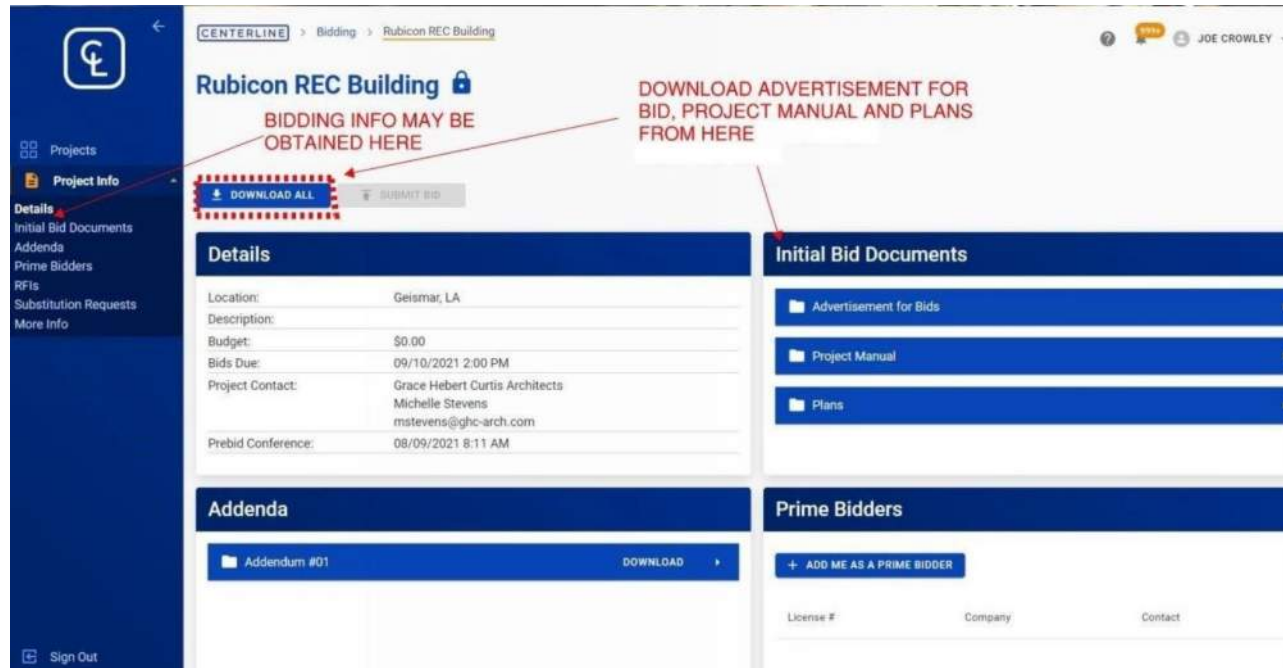
2. Type in your username (complete email address) and password. (if you forgot it, press "forgot password", your password will be emailed to you. Go back to login screen.



3. The first time you log in, you will be asked to change your password.
4. You will be taken to a page that looks like the screenshot on the next page that reads "Projects Out for Bid".
5. Once in scroll until you will see the project name that you are looking for.
6. Click on the project.
7. The BID MODULE IS ON THE LOWER LEFTHAND SIDE OF THE SCREEN.



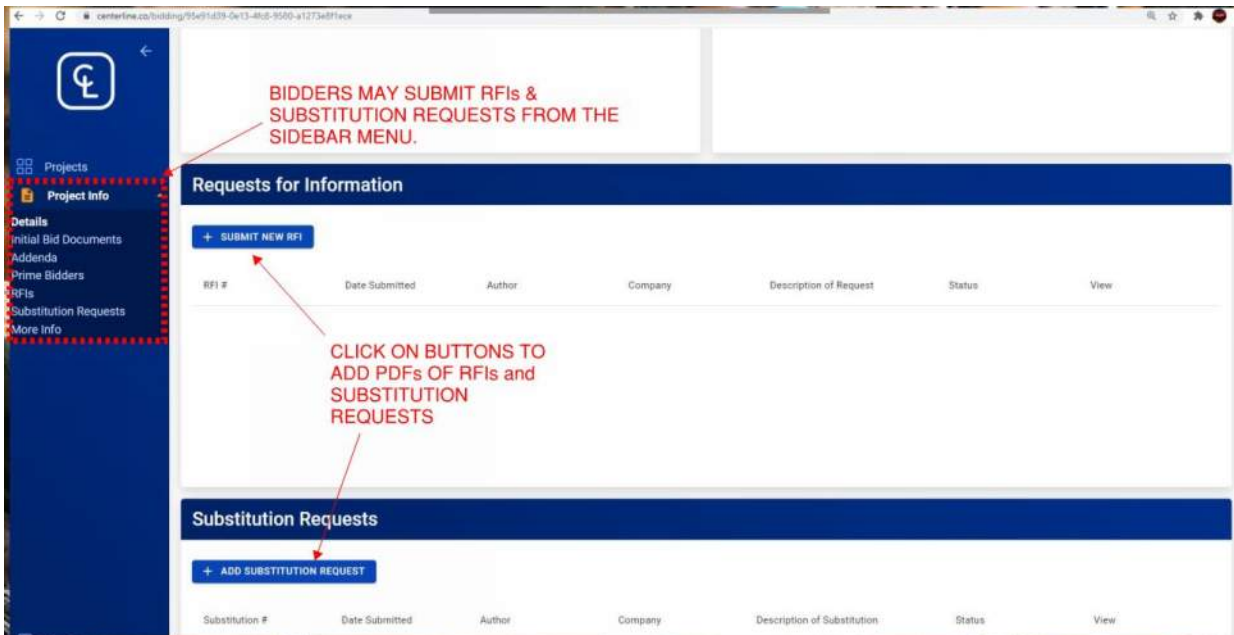
8. Select Project Info and a drop down menu is seen to the left.
9. You may download all Bid Documents, add yourself as a prime bidder and submit a bid on this page. Addenda, Prime Bidders, RFIs, Substitution Requests and More Info are placed here.
10. Print and download any info from this page.



END OF SECTION

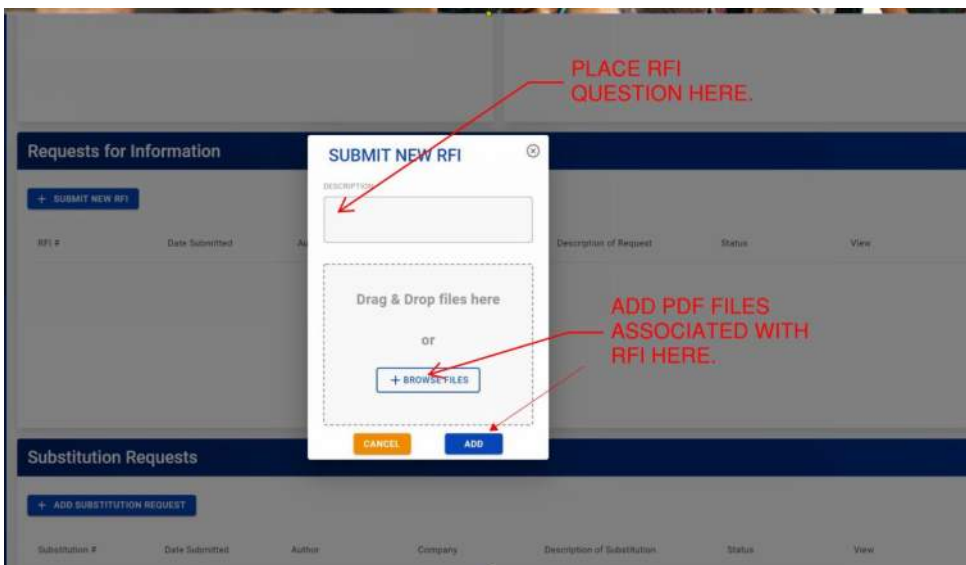
00 0016b - HOW TO ENTER REQUEST FOR INFORMATION (RFI) AND SUBSTITUTION REQUESTS FROM BIDDING SIDE

Once the bid is set up, and the User chooses the project and enters the password if a private bid, they will see the Submit buttons for NEW RFI's and SUBSTITUTION REQUESTS.

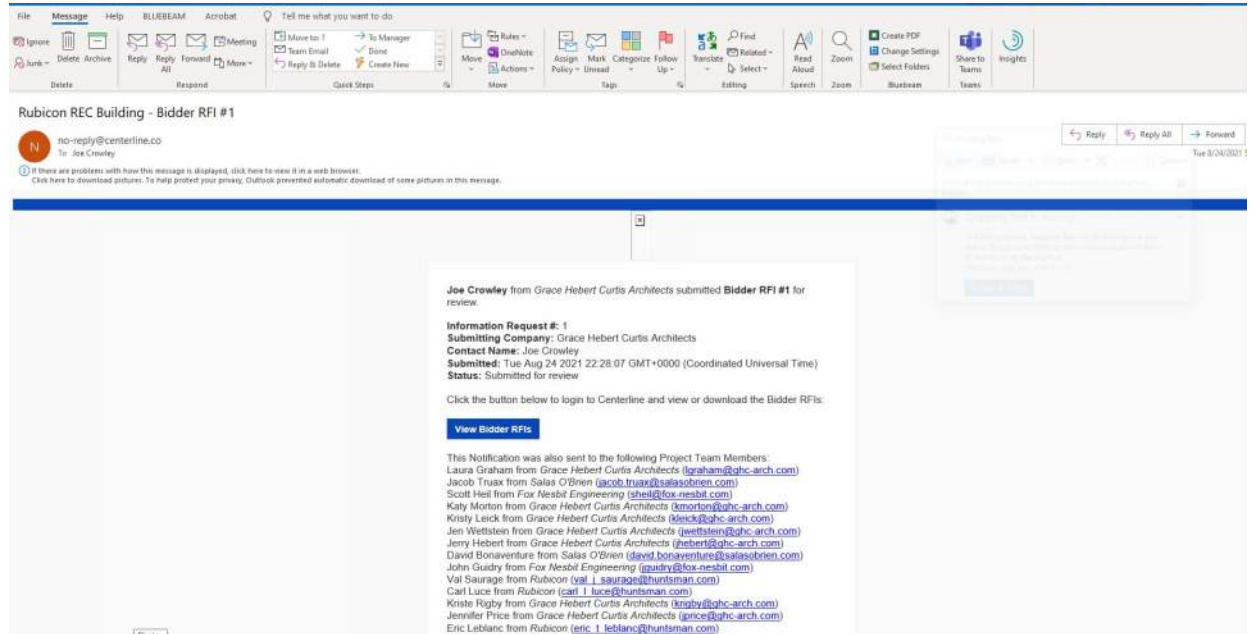


RFI

This is the SUBMIT NEW RFI form the contractor/sub-contractor will get. **Simply fill in the information and attach files and press SUBMIT RFI. Your RFI will then appear in the log below.**



Once it is submitted, the User will receive an email to the person submitting it that it has been received. The Architect will receive a notification they have received an RFI for his project. You can click on the blue button in the email to take you to the RFI.



SUBSTITUTION REQUEST

This is what the Substitution Request looks like.

Simply fill in the information, attach necessary files and press **SUBMIT SUBSTITUTION REQUEST.**

The screenshot displays a web application interface. On the left is a dark blue sidebar with a logo and a menu containing 'Projects', 'Project Info', 'Details', 'Initial Bid Documents', 'Schedule', 'Open Bidders', 'RFIs', 'Substitution Requests', and 'More Info'. The main content area is titled 'Requests for Information' and features a '+ SUBMIT NEW RFI' button. Below this is a table with columns 'RFI #', 'Date Submitted', and 'Author'. A single row is visible with the values '1', '08/24/2021 17:28', and 'Joe Crowley'. Below the table is a section titled 'Substitution Requests' with an '+ ADD SUBSTITUTION REQUEST' button. An 'ADD SUBSTITUTION REQUEST' modal form is open on the right, containing the following fields: 'SPEC SECTION', 'PAGE NUMBER' (with '0' entered), 'PARAGRAPH NUMBER' (with '0' entered), 'DESCRIPTION OF SUBSTITUTION', 'PROPOSED SUBSTITUTION', 'REASON FOR SUBSTITUTION', 'LIST WAYS IN WHICH THE PROPOSED SUBSTITUTION AFFECTS DIMENSIONS SHOWN ON DRAWINGS', and 'LIST EFFECTS OF PROPOSED SUBSTITUTION ON OTHER TRADES'.

When you see the Substitution Request appear on the list where you submitted it, your Substitution Request has been submitted; you may VIEW the document and save or print as well from this location by clicking on the VIEW eyeball icon.

Once it is submitted, similar to RFIs, the User will receive an email noting that it has been received and the Architect will receive a notification that there is a Substitution Request for the project.

00 0005c – HOW TO ENTER REQUEST FOR CHANGE DURING CONSTRUCTION

Once the construction tab is open, and the User chooses the project and may select Request for Change to view documents that the Contractor is to price:

CENTERLINE > Ochsner West Metairie

OCHSNER WEST METAIRIE

233/580 Days
\$2,500.00 per day LD

OCTOBER 16, 2022

Upcoming

ALL ASSIGNED TO ME ASSIGNED BY ME TO OTHERS

SELECT Request for Change from the side menu

DUE	PROJECT	TYPE	ITEM	STATUS
16 June	Ochsner West Metairie	Consultant Review - Requests For Information	PreCon21	Submitted For Review
17 June	Ochsner West Metairie	Consultant Review - Requests For Information	PreCon4	Submitted For Review
20 July	Ochsner West Metairie	Consultant Review - Submittals	08 43 13	Under Review
20 July	Ochsner West Metairie	Consultant Review - Submittals	08 43 13	Submitted For Review
20 July	Ochsner West Metairie	Consultant Review - Submittals	08 44 13	Submitted For Review

ROWS PER PAGE: 5

Message Board Project Directory

Recent Project Activity Clear All

Today

Submittal 055100-09 REV 1 - Stair 1 - Shop Drawings - BRM RFC 010 (GHC RFC 014)

RFCs

The list of RFCs are displayed with the RFC #, brief description, potential impact to cost, impact to time, date submitted and current responsible party shown as seen below:

☐	RFC #	TITLE	DESCRIPTION	IMPACT TO COST	IMPACT TO TIME	SUBMITTED	CURRENT RESPONSIBLE PARTY
☐	001	South EIFS	Removal of EIFS at the South Exterior Elevation \$6,699.00 Incorporated into GMP.	\$0.00	TBD	05/05/2021	Not As
☐	001 - B	Addendum 5	Broadmoor RFC for Addendum 5, GHC requested complete breakdown, Broadmoor workin...	\$120,466.00	TBD	10/06/2021	Grace Hebert Curtis Architects Joe Crowley
☐	002	3HR walls 1st floor West	New 3-Hour Rated Walls \$11,553 Incorporated into GMP.	\$0.00	TBD	05/05/2021	Not As
☐	002 - B	Addendum 6	Broadmoor RFC for Addendum 6 attached for GHC review	\$33,207.00	TBD	10/06/2021	Grace Hebert Curtis Architects Joe Crowley
☐	003	Infill Rooftop Openings	RFC 003 - Addendum 1 (Infill at Rooftop Openings) \$38,314 Incorporated into GMP...	\$0.00	TBD	05/18/2021	Not As

To print or save a copy of the RFC Log in PDF or Excel, click on the **red rectangle** in the upper right seen above.

Scroll down to view **SUPPORTING DOCUMENTS** which are organized by:

Current File and **Previous Files**.

The Architect will place the **Current File** to be reviewed and responded to by the Contractor under the **Current File** tab **highlighted below**.

Only the files necessary to price the RFC will be located here. Previous files will be considered superseded by the **Current File**. Previous files may include a version of the Contractor's proposal with backup. Each file is date and time stamped to be able to easily track history of each document version.

Minimize to not view all previous files if printing a summary page or expand to view previous version of files. See red circled area in the screenshot below.

Important Note to Architect, Contractor, et al:

Current file must be a single file.

If posting multiple files, i.e.: drawings, specifications, sketches, narratives, cutsheets and similar, Zip the files together and post the Zip folder. If files are similar in size format, i.e.: ALL full size drawings, they may be included in a single file PDF as well and posted.

The screenshot shows a software interface for managing Request for Change (RFC) documents. The interface is divided into a sidebar on the left, a main content area, and a right sidebar.

Sidebar (Left): Contains navigation options: Dashboard, Calendar, Design, Bidding, Construction (highlighted), Construction Management, Drawings, Specifications, ASI Documents, Submittals, Requests for Information, Change Orders, Const. Change Directives, Potential Change Orders, Requests for Change, Work Change Proposal Req., Pay Applications, Contractor Daily Logs, Field Reports, Meeting Minutes.

Main Content Area:

- Header:** DUE ON 10/21/2021, EDIT button.
- Section:** RFC #001 - B Supporting Items.
- Description:** Broadmoor RFC for Addendum 5, GHC requested complete breakdown, Broadmoor working on.
- Current File:** A red dashed box highlights this section. It contains a file named "RFC 001 - Addenda 5 Rev 3.pdf" uploaded by Joe Crowley, Grace Hebert Curtis Architects on 11/02/2021 @ 4:01 PM. Below the file are buttons for VIEW, DOWNLOAD, and DELETE. A red arrow points to the "MINIMIZE (-) & EXPAND (+)" button for this section.
- Previous Files:** A red dashed box highlights this section. It contains two files:
 - RFC 001 - Addenda 5 Rev1 (10.11.2021).pdf uploaded by Joe Crowley, Grace Hebert Curtis Architects on 10/25/2021 @ 4:52 PM.
 - RFC 001 - Addenda 5 (09.23.2021).pdf uploaded by Jimmy Hebert, Grace Hebert Curtis Architects on 10/06/2021 @ 9:15 AM.Each file has buttons for VIEW, DOWNLOAD, and DELETE. A red arrow points to the "MINIMIZE (-) & EXPAND (+)" button for this section. A red circle highlights the minimize button for the "Previous Files" section.
- Section:** RFC #001 - B Comments

Right Sidebar: A list of users who have viewed or downloaded the document:

- Nov 02 Scott Johnson, Centerline Admin, viewed this document (11/02/2021 @ 6:48 PM)
- Nov 02 Joe Crowley, Grace Hebert Curtis Architects, viewed this document (11/02/2021 @ 4:43 PM)
- Nov 02 Joe Crowley, Grace Hebert Curtis Architects, viewed this document (11/02/2021 @ 4:02 PM)
- Nov 02 Joe Crowley, Grace Hebert Curtis Architects, uploaded 1 file RFC 001 - Addenda 5 Rev 3.pdf (11/02/2021 @ 4:01 PM)
- Nov 02 Joe Crowley, Grace Hebert Curtis Architects, viewed this document (11/02/2021 @ 4:01 PM)
- Nov 02 Joe Crowley, Grace Hebert Curtis Architects, downloaded a file RFC 001 - Addenda 5 Rev1 (10.11.2021).pdf (11/02/2021 @ 4:00 PM)
- Nov 02 Joe Crowley, Grace Hebert Curtis Architects, viewed this document (11/02/2021 @ 3:59 PM)
- Oct 29 Royce Girouard, Broadmoor, viewed this document (10/29/2021 @ 10:56 AM)
- Oct 29 Stephen Millet, Broadmoor, viewed this document (10/29/2021 @ 9:57 AM)

Comments relevant to the RFC are below the Previous Files and are date and time stamped. Anybody in the distribution group may add comments here. While they are not part of the current file, they may modify the Request for Change and need to be reviewed. Status updates and similar comments may also be added here.

The screenshot displays a software interface with a sidebar menu on the left. The main content area is divided into sections. The 'Previous Files' section lists two PDF files: 'RFC 001 - Addenda 5 Rev1 (10.11.2021).pdf' by Joe Crowley and 'RFC 001 - Addenda 5 (09.23.2021).pdf' by Jimmy Hebert. Below this is the 'COMMENTS' section, which is titled 'RFC #001 - B Comments'. A red dashed box highlights the comment input area, which includes a text field labeled 'Type here... *' and a 'COMMENT' button. To the right of the input area is a list of two comments, both from Joe Crowley, Grace Hebert Curtis Architects. The first comment, dated 10/29/2021 @ 9:49 AM, states: 'All doors, frames and hardware to be priced & reviewed in CCD #01 per RFC 10 and RFC 27 pricing.' The second comment is partially visible. The right sidebar shows a list of recent activities, including file downloads and document views by Joe Crowley and Royce Girouard.

SECTION 00 0017 – APPLIED TECHNOLOGY COUNCIL (ATC) WINDSPEED DETERMINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Applied Technology Council (ATC) Windspeed Determination for the proposed Hahnville Branch Library located at 15090 River Road, Hahnville, LA 70057.

PART 2 - PRODUCTS (Not Used)

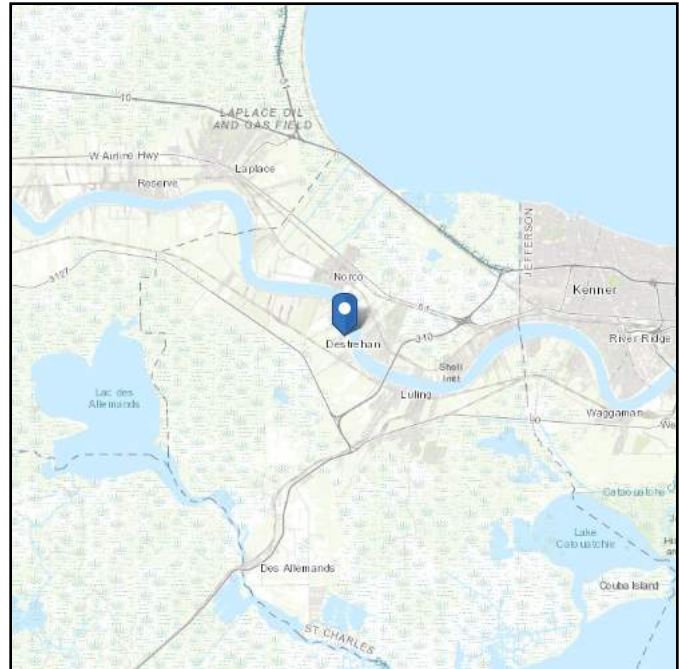
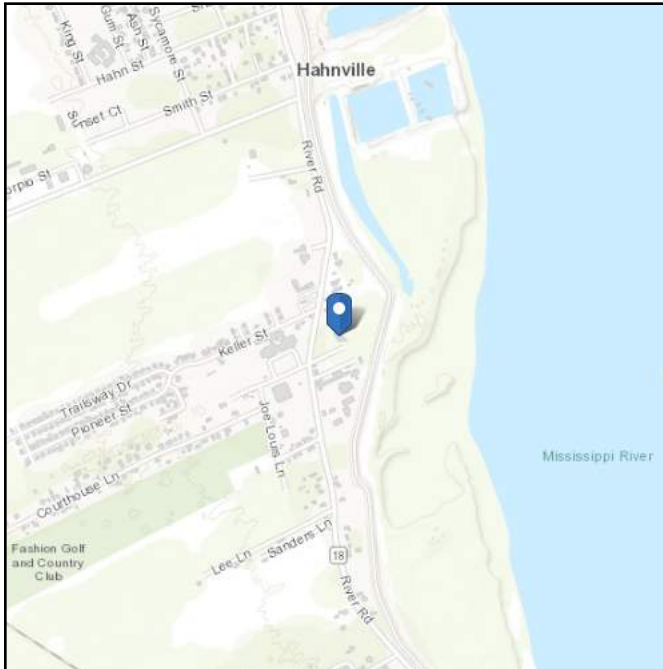
PART 3 - EXECUTION (Not Used)

ASCE Hazards Report

Address:
15090 River Rd
Hahnville, Louisiana
70057

Standard: ASCE/SEI 7-22
Risk Category: II
Soil Class: Default

Latitude: 29.965495
Longitude: -90.404605
Elevation: 13.126114954156401 ft
(NAVD 88)



Wind

Results:

Wind Speed	134 Vmph
10-year MRI	78 Vmph
25-year MRI	92 Vmph
50-year MRI	103 Vmph
100-year MRI	112 Vmph
300-year MRI	125 Vmph
700-year MRI	134 Vmph
1,700-year MRI	142 Vmph
3,000-year MRI	147 Vmph
10,000-year MRI	158 Vmph
100,000-year MRI	174 Vmph
1,000,000-year MRI	190 Vmph

Data Source: ASCE/SEI 7-22, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Wed Oct 22 2025



Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-22 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years). Values for 10-year MRI, 25-year MRI, 50-year MRI and 100-year MRI are Service Level wind speeds, all other wind speeds are Ultimate wind speeds.

Site is in a hurricane-prone region as defined in ASCE/SEI 7-22 Section 26.2. Glazed openings need not be protected against wind-borne debris.

The ASCE Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

ASCE does not intend, nor should anyone interpret, the results provided by this Tool to replace the sound judgment of a competent professional, having knowledge and experience in the appropriate field(s) of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the contents of this Tool or the ASCE standard.

In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE Hazard Tool.

SECTION 01 1000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Construction Areas.
 - 4. Access to site.
 - 5. Coordination with occupants.
 - 6. Work restrictions.
 - 7. Specification and drawing conventions.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

- A. Project Identification: Hahnville Branch Library
 - 1. Project Location: 15090 River Road, Hahnville, LA 70057.
- B. Owner: St. Charles Parish Library, 160 West Campus Drive, PO Box 1029, Destrehan, LA 70047.
- C. Architect: Grace Design Studios, LLC, 601 Poydras Street, Ste 2310, New Orleans, LA 70130

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project includes new construction of a single story library consisting of an LA History room, an adult book section, a teen book section, a children's book section, four study rooms, two meeting rooms, administrative spaces and ancillary spaces.
- B. Type of Contract:
 - 1. Project will be constructed under a single prime contract.

1.4 CONSTRUCTION AREAS

- A. The Work shall be conducted in areas as indicated within the drawings.
 - 1. Contractor to coordinate with Owner for location and submit a site plan indicating lay down areas, location of job trailer (if applicable), temporary electrical (if applicable), dumpsters, temporary toilets, etc. for Architect and Owner's approval prior to commencing Work.
 - 2. Before commencing Work within each area, submit an updated copy of Contractor's construction schedule showing the sequence, commencement, and completion dates for all areas of the Work.

1.5 ACCESS TO SITE

- A. General: Contractor shall have use of Project site for construction operations during construction period as indicated.
- B. Use of Site: Limit use of Project site to work in areas indicated in Construction Area drawings. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine construction operations to the limits indicated.

2. 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 impacts to adjacent roadways by construction operations. Do not obstruct roadways, sidewalks or other public ways without permit.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
 - c. Schedule deliveries to avoid conflict with student drop off and pick up times for carpool and busses.

1.6 COORDINATION WITH OCCUPANTS

- A. Owner Occupancy of Areas of Construction: Owner will continue to occupy and utilize the campus throughout construction. Contractor shall coordinate with Owner to schedule work such that it does not disrupt daily classroom operations.
 1. Architect will prepare a Certificate of Substantial Completion prior to Owner acceptance of the completed Work.
 2. Obtain a Certificate of Occupancy from authorities having jurisdiction prior to Certificate of Substantial Completion being issued.
 3. Mechanical and electrical systems shall remain fully operational throughout construction.
 4. On occupancy, Owner will assume responsibility for maintenance and custodial service completed portions of Work.
- B. Cooperate with Owner to minimize conflict and facilitate Owner's operations.
- C. Contractor shall be responsible for maintaining a secure site to prevent entry by unauthorized persons to the facility.
- D. Contractor shall be responsible for providing any temporary enclosures or fences necessary to keep students out of construction scope areas while work is in progress or incomplete where the area may pose a safety hazard.
- E. Contractor shall maintain all required egress components from the work area and surrounding area of campus.

1.7 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: Work hours shall occur within the requirements of authorities having jurisdiction and shall comply with all noise ordinances.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 1. Notify Architect/Owner not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect/Owner's written permission.
- D. Nonsmoking Building and Site: Smoking is not permitted within the building or on site. This is a no-smoking campus.
- E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

- F. Employee Language and Behavior: Use of profane language will not be tolerated on site due to the proximity of the work to the adjacent school facilities. All employees whether employed by the Contractor or Sub-Contractors shall behave appropriately at all times.
- G. Employee Identification: All employees whether employed by the Contractor or Sub-Contractors shall be required to wear their company shirt/logo at all times on site for security purposes.
- H. Employee Screening: Comply with Owner's requirements for drug screening of Contractor personnel working on Project site.
 - 1. Maintain list of approved screened personnel with Owner's representative.

1.8 EXAMINATION OF SITE

- A. Examination of Documents and Site: Contractor shall carefully examine Documents and Construction Site to obtain first-hand knowledge of scope and the conditions of the Work. The Contractor, by signing a Contract to perform the Work, represents and warrants that he has examined Drawings, Specifications and site of the Work and from his own investigation has satisfied himself as to scope, accessibility, nature and location of Work, character of equipment and other facilities needed for performance of work, character and extent of work to be performed, local availability, practices, and jurisdiction and other circumstances that affect performance of work. Contractor shall make sufficient investigation to ascertain that existing conditions are as represented on the Drawings and that the final results can be achieved as shown on the Drawings. No additional compensation will be allowed by the Owner for failure of Contractor to fully inform himself as to conditions affecting work. Dimensions and conditions of existing buildings shown on the Drawings are taken from original construction documents and may not represent actual conditions, and should be assumed to be approximate. The Contractor shall verify ALL existing dimensions and conditions, which would affect new work or renovations before proceeding with actual construction. Contractor will not be entitled to additional compensation if existing dimensions or conditions vary from that shown on the Contract Documents
- B. Contractor's Representation: By executing the Contract, the Contractor represents that he has:
 - 1. Visited the site.
 - 2. Made due allowances for difficulties and contingencies to be encountered, including, but not limited to environmental restrictions, if any.
 - 3. Compared Contract Documents with work in place.
 - 4. Informed himself of existing conditions; and,
 - 5. Notified the Architect of ambiguities, inconsistencies, and errors discovered in the Contract Documents, or between the Contract Documents and existing conditions.
 - 6. Responsibility: Failure to visit the site and perform attendant responsibilities listed above shall not relieve the Contractor or any Subcontractor from their obligations, and no extra payment will be authorized for work related to conditions which can be determined by examination of the site and the Contract Documents

1.9 PROTECTION OF PROPERTY

- A. Protection: The Contractor shall take all reasonable precautions to protect existing property, systems and equipment. At completion of Work, all areas of the site damaged or otherwise adversely affected by the work under this Contract shall be repaired, replaced, or otherwise returned to their original conditions without cost to the Owner

1.10 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 scheduled on Drawings.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

**SECTION 01 2500
SUBSTITUTION PROCEDURES**

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
 - 1. Substitutions for Convenience (as defined in this Section): Will only be considered in the Bidding Phase only in accordance with the Instructions to Bidders. Substitutions for convenience must be submitted electronically via www.centerline.co
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
 - 2. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

1.03 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.

1.04 ACTION SUBMITTALS

- A. Substitution Requests: Submit electronic copies 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 (During Construction): Submit electronically via www.centerline.co. Requests for substitution will be considered if received within 60 calendar days after commencement of the Work (Notice to Proceed). Requests received more than 60 calendar days after commencement of the Work may be considered or rejected at the discretion of the Architect.
 - 2. Substitution Request Form (Bidding Phase): Submit electronically via www.centerlinebidconnect.com. Submit during the bidding phase for consideration of substitutions prior to submittal of bids in accordance with the Instructions to Bidders, within 15 calendar days if not noted otherwise in the Instructions to Bidders.
 - 3. 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.
4. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation. Within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.05 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.

1.06 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 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.
 - 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. Substitutions for Convenience: Submit requests for substitution for convenience electronically.
- 1. General: Architect will consider requests for substitution if received within 7 working days of the bid opening date, as per Instructions to Bidders. Requests received after that time will not be considered by Architect.
 - 2. Conditions for Consideration: 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 offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.
 - j. 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.

PART 3 EXECUTION (NOT USED)

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**SECTION 01 2600
CONTRACT MODIFICATION PROCEDURES**

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.03 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, via www.centerline.co.

1.04 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Provide information on AIA Document G701
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

6. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Provide information on AIA Document G701.

1.05 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.06 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. Throughout the duration of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the contract within 10 days from the date materials are procured, equipment is utilized and man hours are performed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

**SECTION 01 2900
PAYMENT PROCEDURES**

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 01 2600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 01 3000 "Submittal Procedures" for administrative requirements governing the preparation and submittal of submittal schedule.
 - 3. Section 01 3200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.03 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 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 initial schedule of values to Architect and Owner at the Pre-Construction Conference, on the Schedule of Values form provided as part of these Specifications. If form is not provided in these Specifications, Schedule of Values is to be submitted on AIA Document Form G703 "Continuation Form".
- 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. Owner's name.
 - c. Owner's Project Number.
 - d. Name of Architect.
 - e. Architect's Project Number
 - f. Contractor's name and address.
 - g. Date of submittal.
 - 2. Arrange schedule of values consistent with format of Schedule of Values included as part of these Specifications, or AIA Document G703, if no form is provided as part of these Specifications.
 - 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 percent of the Contract Sum.

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. 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.
- C. A Schedule of Values shall be submitted by the Contractor in Excel format along with the Pay Application each month.

1.05 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Progress payments shall be submitted to Architect seven days before the regularly scheduled monthly progress meeting. The period covered by each Application for Payment is one month, ending on the last day of the month.
 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:

- a. Value of materials previously stored and included in previous Applications for Payment.
 - b. Work completed for this Application utilizing previously stored materials.
 - c. Additional materials stored with this Application.
 - d. Total materials remaining stored, including materials with this Application.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien (*Except Publicly Funded Projects*): With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 1. List of subcontractors.
 2. Schedule of values, both hard copy and in Excel format.
 3. Contractor's construction schedule (preliminary if not final).
 4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
 5. Products list (preliminary if not final).
 6. Schedule of unit prices.
 7. Submittal schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. List of Contractor's principal consultants.
 10. Copies of building permits.
 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 12. Initial progress report.
 13. Report of preconstruction conference.
 14. Certificates of insurance and insurance policies.
 15. Performance and payment bonds.
 16. Data needed to acquire Owner's insurance.
 17. Fixed job site overhead cost itemized as per 7.1.4 of the AIA A201 – 2007, General Conditions of the Contract for Construction as amended herein
- I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

- J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Certification of completion of final punch list items.
 3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 4. Updated final statement, accounting for final changes to the Contract Sum.
 5. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 6. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 7. AIA Document G707, "Consent of Surety to Final Payment."
 8. Evidence that claims have been settled.
 9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 10. Final liquidated damages settlement statement.
 11. Proof that taxes, fees, and similar obligations are paid.
 12. Waivers and releases.

PART 2 EXECUTION (NOT USED)

PART 3 EXECUTION (NOT USED)

**SECTION 01 3000
SUBMITTAL PROCEDURES**

PART 1 GENERAL

1.01 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.

1.02 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 2900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 01 3100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
 - 3. Section 01 3200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 4. Section 01 3233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
 - 5. Section 01 4000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
 - 6. Section 01 7700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
 - 7. Section 01 7800 "Closeout Submittals" for submitting Operations & Maintenance Manuals & record drawings & record specifications.
 - 8. Section 01 7900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.03 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 do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. Centerline: Centerline is a web based project management system to be used on this project. All project information will be maintained on this system. Information contained on this system will be the official log of all project information. The contractor shall pay all fees associated with his access to this project management system.
- D. 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.
- E. Bluebeam Document (BSX): A standard file format licensed by Bluebeam Software, Inc. and available for use in creating, marking up, collaborating, and sharing PDF documents. Contractor shall pay all fees for access to this program for this project.

1.04 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

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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. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final 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.
4. 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 dates for installation.

1.05 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies in PDF format of the Contract Drawings will be provided one time by Architect for Contractor's use in preparing submittals.
 1. Architect will furnish Contractor digital AutoCAD drawing files, indicated below, for use in preparing Shop Drawings and Project record drawings within 21 days of receiving request for files.
 - 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 AutoCAD 2018 or higher.
 - c. Contractor shall execute a data licensing agreement in the form of the Architect's CAD Release Letter included at the end of this Section.
 - d. The following AutoCAD files only will be furnished for each appropriate discipline:
 - 1) Overall floor plans.
 - 2) Overall reflected ceiling plans.
- B. 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 reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. Submittals posted or received after 3:00 PM will be considered as received the following working day. 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: Allow 15 days for initial review of each submittal. 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 15 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned Architect before being returned to Contractor.
 6. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- D. Electronic Submittals: 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 or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., JSC512-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., JSC512-061000.01.A).
 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, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Architect.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.
 - i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.
 - n. Related physical samples submitted directly.
 - o. Indication of full or partial submittal.
 - p. Transmittal number, numbered consecutively.
 - q. Submittal and transmittal distribution record.
 - r. Other necessary identification.
 - s. Remarks.
 5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.

- d. Product name.
- E. Provide on the label or beside the title block on the submittal a place to record the Contractor's review and approval markings and the action taken.
 - 1. The Contractor's review markings must include the following information:

"This shop drawing has been reviewed by (Name of Contractor) and approved with respect to the means; methods; techniques; sequences and procedures of construction, and safety precautions and programs incidental thereto. (Name of Contractor) also warrants that this shop drawing complies with contract documents and comprises no variations thereto".
 - 2. **SUBMITTALS WITH NO REMARKS OR NOTATIONS MADE BY THE CONTRACTOR WILL BE RETURNED AS NOT SATISFYING CONTRACTOR'S REVIEW REQUIREMENT.**
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. 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. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- I. 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.
- J. 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 action stamp.

PART 2 PRODUCTS

2.01 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Post electronic submittals as PDF electronic files directly to the Project on www.centerline.co.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
 - 3. 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.
 - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

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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 catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Full range of color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. 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.
 5. Submit Product Data before Shop Drawings, and 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, unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. 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.
- D. Samples: Submit physical 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: Samples submitted without identification or the information below will be returned & not reviewed.
 - 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 physical copies of 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 one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal 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 sets of Samples. Architect will retain two Sample sets; remainder will be returned.
 - 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 at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017800 "Closeout Submittals."
- J. Maintenance Data: Comply with requirements specified in Section 017800 "Closeout Submittals."

- K. 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.
- L. 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.
- M. 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.
- N. 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.
- O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- Q. 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.
- R. 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.
- S. 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.
- T. 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.
- U. 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.
- V. 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.
- W. 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.

2.02 DELEGATED-DESIGN SERVICES

4024101 / Hahnville Branch Library	01 3000 - 7	SUBMITTAL PROCEDURES

- 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 a licensed, (in the state of the project location), 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.
- C. BIM Incorporation: Contractor or Construction Manager will incorporate delegated design drawing and data files into BIM established for Project.
 - 1. Prepare delegated design drawings in the following format: Same digital data software program, version, and operating system as original Drawings).

PART 3 EXECUTION

3.01 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 017800 "Closeout Submittals."
- 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 review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents. Submittals shall be marked up using Bluebeam software: Contractor shall use BLUE color mark ups with Arial 10 point text, Architect shall use RED, Civil - TEAL, Structural - GREEN, Mechanical & Plumbing - PLUM, Electrical - ORANGE, Security - BURNT ORANGE, Landscape - MAGENTA, Audio-Video Consultant - FOREST GREEN and Special Systems - LIGHT PURPLE.
- D. Architect will not review submittals received from Contractor that do not have Contractor's review and approval stamp.

3.02 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
 - 1. Final Unrestricted Release: When the Architect marks a submittal "Approved," or "No Exceptions Taken", the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
 - 2. Final-But-Restricted Release: When the Architect marks a submittal "Approved as Noted," or "Amend as Noted", the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
 - 3. Returned for Resubmittal: When the Architect marks a submittal "Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

- a. Do not use, or allow others to use, submittals marked "Revise and Resubmit" or "Rejected" at the Project Site or elsewhere where Work is in progress.
- 4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Required."
 - a. No Action Required by Architect.
 - b. Released but Unrestricted or Restricted: Where a submittal may be released or restricted release but additional information is requested, the Architect will return the submittal also marked "Submit Specific Item".
- C. 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.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- E. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- F. Architect will return without review submittals received from sources other than Contractor.
- G. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

3.03 ELECTRONIC FILE AGREEMENT LETTER:

- A. Submit the text below in letter format, on contractor letterhead, signed by a authorized signatory of the contractor, to the project Architect to request electronic file documents.

Date

Grace Design Studios, LLC

501 Government St., Suite 200

Baton Rouge, LA 70802

Re: JS Clark 5-12 New School

Dear Project Architect,

We are requesting that Grace Design Studios, LLC, (herein after "Grace"), provide electronic files, floor plans and reflected ceiling plans only), for our convenience and use for the above referenced project, subject to the following terms and conditions:

Grace's electronic files are compatible with AUTOCAD 2018. Grace makes no representation as to the compatibility of these files with specific hardware or software beyond the specified release of the referenced specifications.

Data contained on these electronic files is part of Grace's instruments of service and shall not be used by us or anyone else receiving this data through or from us for any purpose. Use by us or by others will be at our sole risk and without liability or legal exposure to Grace. We agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against GHC, its officers, directors, employees, agents or subconsultants which may arise out of or in connection with your use of the electronic files.

Furthermore, we shall, to the fullest extent permitted by law, indemnify and hold harmless Grace from all claims, damages, losses and expenses, including attorney's fees arising out of or resulting from our use of these electronic files.

These electronic files are not contract documents. Significant difference may exist between these electronic files and corresponding hard copy contract documents due to addendum, change orders or other revisions. Grace makes no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the signed documents prepared by Grace and electronic files, the signed contract document shall govern. We shall be responsible for determining if any

conflict exists. By our use of these electronic files, we are not relieved of our duty to fully comply with the contract documents, including and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate our work with that of other contractors for the project.

Because of the potential that the information presented on the electronic files can be modified, unintentionally or otherwise, Grace reserves the right to remove all indicia of its ownership and/or involvement for each electronic display.

Under no circumstances shall delivery of the electronic files for use by us be deemed a sale by Grace, and Grace makes no warranties, either expressed or implied, of merchantability and fitness for any particular purpose. In no event shall Grace be liable for any loss of profit or any consequential damages. These documents may not be distributed to any other party without the express written consent of Grace.

This request is allowed for floor plans and reflected ceiling plans only.

By signing this document, I agree to the terms above.

Signature

Date

**SECTION 01 3100
PROJECT MANAGEMENT AND COORDINATION**

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Requests for Information (RFIs).
 - 3. Project meetings.
- B. Contractor shall prepare and submit any and all items electronically via www.centerline.co. Email shall not be considered the means of notification of any item to the Architect, all contract communication shall be thru Centerline.
- C. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- D. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.03 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.04 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 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.

1.05 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.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. 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.
- D. 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.

1.06 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in Section 013113 "Project Coordination Drawings (" 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.

1.07 KEY PERSONNEL

- A. 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 office and cellular telephone numbers and email 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.

1.08 REQUESTS FOR INFORMATION (RFI'S)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI electronically via www.centerline.co.
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. 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.
 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.
- C. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) working days for Architect's response for each RFI. RFIs received by after 1:00 p.m. will be considered as received the following working day.
1. The following 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.
 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 Division 1 Section "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 10 days of receipt of the RFI response.
- D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were dropped and not submitted.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

- E. 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) days if Contractor disagrees with response.
 - 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 - 2. Identification of related Change Order, Work Change Directive, and Proposal Request, as appropriate.

1.09 PROJECT MEETINGS

- A. General: Architect will schedule and conduct weekly 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) days of the meeting.
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 - 1. Attendees: Authorized representatives of Owner, 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. Contractor to provide the following items to Owner at Preconstruction Conference:
 - a. General Contractor Project Team.
 - b. Licenses, Insurance and Bonds.
 - c. List of Sub-contractors and major suppliers.
 - d. Cost breakdown (Schedule of Values), shall be in standard Construction Specifications Institute format.
 - e. Construction Schedule.
 - f. Fixed jobsite overhead cost itemized with documentation to support daily rates.
 - g. Bond Premium Rate with supporting information from the General Contractor's carrier.
 - h. Labor Burden by trade for both Subcontractors and General Contractor.
 - i. Internal Rate Charges for all significant company owned equipment.
 - 3. 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. Preparation of record documents.
 - m. Use of the premises.
 - n. Work restrictions.
 - o. Working hours.

- p. Responsibility for temporary facilities and controls.
 - q. Procedures for moisture and mold control.
 - r. Procedures for disruptions and shutdowns.
 - s. Construction waste management and recycling.
 - t. Parking availability.
 - u. Office, work, and storage areas.
 - v. Equipment deliveries and priorities.
 - w. First aid.
 - x. Security.
 - y. Progress cleaning.
4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
- 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 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. Sustainable design requirements (if applicable).
 - i. Review of mockups.
 - j. Possible conflicts.
 - k. Compatibility requirements.
 - 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 the earliest feasible date.
- D. Project Closeout Conference: Architect will schedule and conduct a Project closeout conference, at a time convenient to Owner and Architect, but no later than 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 preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Coordination of separate contracts.
 - 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: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Architect, {Contractor} will conduct progress meetings once a month, unless otherwise determined at Pre-Construction Conference or as per Owner requirements.
1. Date of monthly progress meetings will be coordinated and determined at Pre-Construction Conference.
 2. Attendees: In addition to representatives of Owner, 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) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.

- 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
 - 19) Top concerns.
 - 20) Meeting plus/minus takeaways.
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.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

**SECTION 01 3113
PROJECT COORDINATION DRAWINGS (BIM)**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Divisions 01 and Specification Sections, apply to this Section.

1.02 DESCRIPTION

- A. Contractor shall coordinate construction operations, included in various Sections of Specifications as provided to assure efficient and orderly installation of all parts of Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
- B. Coordination drawings: Contractor shall produce a BIM Model in REVIT and provide reproducible drawings and PDF's as required in submittals showing work with horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions, equipment, lights, mechanical, electrical, conveying systems, and other services:
1. In the above ceilings.
 2. Within walls.
 3. Within chases.
 4. Entire structural system including foundation system.
 5. In mechanical spaces.
 - a. All ductwork.
 - b. All sprinkler piping.
 - c. All plumbing piping.
 6. In electrical spaces and rooms.
 - a. All conduit - 3/4" or larger.
 - b. All electrical items, such as but not limited to panels, transformers, disconnect switches, etc.
 7. Coordinate mechanical, electrical, plumbing, security, telcom, sewer, and all work including all penetrations, sleeves, and connections secured and watertight.
 8. Coordinate all exterior roof elements at or around rooftop equipment and penetrations of any type, panels, screens, windows, signage, both similar and dissimilar surfaces and elevations ensuring that all installations beneath and adjacent to the exterior envelope are secure, watertight, and tolerant of wind, rain, and storm loads and requirements called for in the specifications.
 9. Notify Architect of any conflicts prior to submittal of submittals so that any required modifications can be made prior to ordering any materials.
- C. Prepare BIM Model in REVIT. All coordination models should be developed to a LOD 350. The recommended platform for clash detection is Autodesk BIM 360 Glue. The contractor may use whatever software they wish to develop the various coordination models for each discipline, but they must be converted into an Autodesk Revit file (2021 or later) prior to being handed over to the Owner with the Record Drawings.
- D. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
- E. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
- F. Work out all "tight" conditions involving Work of various Sections in advance of installation.
- G. Sleeve, coredrill and blockout layout drawings: Drawings showing proposed locations and sizes of sleeves, coredrills blockouts, and embedded items in concrete walls, columns, floors and beams.

- H. Prior to start of work and installation in any given area, Subcontractor to which Contractor is under contract shall approve, sign, coordination drawings affecting the Contractor/Subcontractor's work in that area.
- I. Modifications required as result of failure to resolve interferences, provide correct coordination drawings, or call attention to changes required in other work as result of modifications.
- J. Coordination meetings shall be scheduled by the Contractor, with all affected Subcontractors.

1.03 PRODUCTION OF COORDINATION DRAWINGS

- A. The Contractor shall "build" a BIM model in REVIT to be updated during construction and serve as the final As-Built drawings. A full time BIM Coordinator shall be assigned to the project, and is required to attend all project meetings on site, to facilitate REVIT model to be updated during Construction. Contractor shall also provide copies and PDFs of elevation and section drawings, both as paper hard copies showing:
 - 1. Partitions.
 - a. Fire/smoke rated barriers.
 - 2. Ceiling heights.
 - 3. Structural framing locations and elevations.
 - 4. Column lines.
 - 5. Location of electrical generators.
 - 6. Tie in locations of sewer, water, cable, telephone, electrical connections, fiber and all other connections to the building.
 - 7. Location of security equipment.
 - 8. Location of elevator equipment.
 - 9. Coordination between all the above.
- B. Contractor shall provide as is contracted per individual trade, coordination drawings in order for Subcontractor to produce combined coordination layout drawings plan and sections of HVAC ductwork, hydronic, steam, condensate, fuel oil, fire protection piping, plumbing, special water systems, gas systems, electrical cable tray, electrical generator, conduit, conveying systems, equipment and other work, where applicable.
- C. Contractor shall work to resolve major interferences at initial coordination meeting prior to production of any drawings.
- D. Contractor shall produce initial coordination drawings 90 days after contract award.
- E. Contractor at no cost to Owner, shall meet with Architects and Project Managers to resolve interference's and correct drawings.
- F. Contractor shall determine method used to resolve interference's not previously identified, and obtain Architect's approval of corrected deficiencies.
- G. Maintain one copy of current approved Coordination Drawings at project site and a copy of the BIM Model with computer capacity to access the model on site.

1.04 PRODUCTION OF LAYOUT DRAWINGS

- A. Contractor shall provide to Owner scale plan and elevation drawings, in CAD format preferably for use with REVIT.
- B. Subcontractors shall indicate to Contractor, proposed location and size of their required sleeves, coredrills, blockouts and embedded items.
 - 1. At floor slabs and walls to be core drilled or cut, Contractor shall find and mark all reinforcing in both faces located by means of x-ray, pach-ometer, or prof-ometer. Submit sketch showing location of rebar and proposed cores for review and approval by Architect.

1.05 SUBMITTALS

- A. Project information:
 - 1. BIM Coordination Model in REVIT.
 - 2. Contractor's approved Coordination Drawings.

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- a. Letter indicating one copy of approved Coordination Drawings available at project site.
 - b. One copy of approved Coordination Drawings to the Owner/General Contractor for information, if requested.
 - c. Closeout documents shall include a BIM Model with As-Built conditions in REVIT.
3. Contractor's proposed sleeve, core drill and blockout layout drawings.

**SECTION 01 3200
CONSTRUCTION PROGRESS DOCUMENTATION**

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
1. Startup construction schedule.
 2. Contractor's construction schedule.
 3. Construction schedule updating reports.
 4. Daily construction reports.
 5. Material location reports.
 6. Site condition reports.
 7. Special reports.
- B. Related Requirements:
1. Section 01 2900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.
 2. Section 01 3000 "Submittal Procedures" for submitting schedules and reports.
 3. Section 01 4000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.03 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.

1.04 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. PDF electronic file.
- B. Startup construction schedule.
 - 1. Approval of cost-loaded start-up construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- E. 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 commencement of the Work until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.
- H. Material Location Reports: Submit at monthly intervals.
- I. Field Condition Reports: Submit at time of discovery of differing conditions.
- J. Special Reports: Submit at time of unusual event.
- K. Qualification Data: For scheduling consultant.

1.05 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.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including work stages and interim milestones.
 - 4. Review submittal requirements and procedures including review time required for review of submittals and resubmittals.
 - 5. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 6. Review time required for completion and startup procedures, including commissioning activities.
 - 7. Review and finalize list of construction activities to be included in schedule.
 - 8. Review procedures for updating schedule.

1.06 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

2.01 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 principal element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 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 30 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 Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include not less than 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 30 days for punch list 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. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner - if applicable.
 - 3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date as coordinated with Owner. Delivery dates indicated stipulate the earliest possible delivery date.
 - 5. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Uninterruptible services.
 - b. Partial occupancy before Substantial Completion.
 - c. Use of premises restrictions.
 - d. Provisions for future construction.
 - e. Seasonal variations.
 - f. Environmental control.
 - 6. 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. Startup and placement into final use and operation.
- D. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
- 1. Structural completion
 - 2. Temporary enclosure and space conditioning
 - 3. Permanent space enclosure.
 - 4. Completion of mechanical installation.
 - 5. Completion of electrical installation.
 - 6. Substantial Completion.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following interim milestones:
- 1. Temporary enclosure and space conditioning.
- F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
- 1. Refer to Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- G. 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 Information.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
 - 5. Pending modifications affecting the Work and Contract Time.
- H. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week 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.
- I. Recovery Schedule: When periodic update indicates the Work is 14 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.

- J. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Start-up Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 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 60 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 correlate with Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the start-up 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.
 - 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.
 5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under principal

subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.

- a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
 - b. Total cost assigned to activities shall equal the total Contract Sum.
- 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. Principal 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.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.03 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site: Daily reports are to be submitted electronically via www.centerline.co.
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 (refer to special reports).
 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. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
 2. Material stored prior to previous report and since removed from storage and installed.
 3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between field 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.

2.04 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one 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

3.01 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 monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week 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

**SECTION 01 3233
PHOTOGRAPHIC DOCUMENTATION**

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Concealed Work photographs.
 - 3. Periodic construction photographs.
 - 4. Final Completion construction photographs.
- B. Related Requirements:
 - 1. Section 013000 "Submittal Procedures" for submitting photographic documentation.
 - 2. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.

1.03 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 image files weekly within three days of taking photographs, via www.centerline.co.
 - 1. Digital Camera: Minimum sensor resolution of 10 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:
 - 4. Name of Project.
 - 5. Name and contact information for photographer.
 - 6. Name of Architect.
 - 7. Name of Contractor.
 - 8. Date photograph was taken.
 - 9. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - 10. Unique sequential identifier keyed to accompanying key plan.

PART 2 PRODUCTS

2.01 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 10 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

- A. 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.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

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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.
- C. Preconstruction Photographs: Before commencement of demolition, take extensive photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
1. Flag construction limits before taking construction photographs.
 2. Take photographs to show existing conditions adjacent to property before starting the Work.
 3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
1. Underground utilities.
 2. Underslab services.
 3. Piping.
 4. Electrical conduit.
 5. Waterproofing and weather-resistant barriers.
- E. Periodic Construction Photographs: Take photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Architect--Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.
- G. Final Completion Construction Photographs: Take color photographs after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.
1. Do not include date stamp.
- H. Additional Photographs: Architect may request photographs in addition to periodic photographs specified.
1. Three days' notice will be given, where feasible.
 2. In emergency situations, take additional photographs within 24 hours of request.
 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 4. Special events planned at Project site.
 5. Immediate follow-up when on-site events result in construction damage or losses.
 6. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 7. Substantial Completion of a major phase or component of the Work.
 8. Extra record photographs at time of final acceptance.
 9. Owner's request for special publicity photographs.

**SECTION 01 3323
MECHANICAL SHOP DRAWINGS**

PART 1 – GENERAL

1.01 SCOPE

- A. Submit for review, shop drawings, wiring diagrams, and other data including electronic copies of files in AutoCad (.dwg) format.
 - 1. The shop drawings shall be a minimum 1/4" scale. All text shall be 3/32" height. The shop drawings shall be clear and legible. All systems including, but not limited to, piping, plumbing, equipment, ductwork, supports, walls, structural items, ceilings, text, electrical, lighting, etc. shall be in individual layers. If shop drawings are not submitted as stated in this section, they will be rejected.
 - 2. The shop drawings shall be done in AutoCAD version 2018 or later. All systems shall be coordinated with structural, architectural, and all other trades.
 - 3. Shop drawings shall be submitted as a single package after the major equipment submittals have been reviewed.
- B. Review of shop drawings shall in no way modify the contract or relieve the Contractor from compliance with the contract.
- C. When electronic submittals are allowed, the Contractor shall also provide to the Architect a minimum of 3 hard copies of the submittal for all submittals that are greater than 25 pages or have a single sheet that is larger than 11 in. x 17 in.
- D. Names of manufacturers or catalog numbers are listed in the Specification in order to establish a standard "basis of design" for the type, general design and quality of the product required. Where "or approved equal" is indicated, other products similar in design and of equal quality and complying with the Drawings and Specifications will be considered for acceptance. See Division 01 – Substitution Procedures.
- E. Shop drawings shall be submitted per Contract Documents. Cuts or catalogs including descriptive literature and characteristics of equipment shall show overall dimensions, maintenance clearance requirements, roughing-in data, capacity, curves, pressure drop, code compliance, motor/drive data and electrical data. Observe special instructions when required.
- F. Prior Approvals: Prior approvals must include the necessary paperwork to verify compliance with the specifications and that the contractor understands and commits to meeting the requirements of the specifications on all items. Any deviations must be clearly identified and listed during the prior approval process.
- G. The mechanical contractor shall provide complete shop drawings for approval prior to construction. The drawings shall be prepared by a sheet metal detailer with a minimum of 5 years experience preparing and specializing in shop drawings. A resume and a sample of the detailers work shall be submitted to the Architect, who will determine if the shop drawing detailer meets the qualifications.
- H. The detailer shall obtain all pertinent equipment submittals and coordinate all trades including fire protection, plumbing, lighting, electrical, ductwork, controls and general contracting work, etc. The shop drawing shall show all air handling equipment, fans, ductwork, diffusers, grilles, VAV terminal units, etc. with all dimensions in plan to a fixed location (i.e. wall, structural column, etc.). Shop drawings shall also indicated elevations (i.e. top of duct, top of pipe, etc.). The shop drawings should show the reflected ceiling, lighting layout, plan and elevation dimensions of all ductwork with respect to ceilings, lighting fixtures and structure above ceiling.
- I. The Contractor shall provide shop drawings with coordinated ductwork, piping, electrical, plumbing, fire protection, equipment and HVAC controls trades. The shop drawings shall include, but not be limited to, HVAC ductwork, chilled and hot water piping and accessories, domestic hot and cold water piping and accessories, waste and vent piping and accessories,

steam piping and accessories, steam condensate piping and accessories, sprinkler piping, electrical and control conduits, all MEP and fire protection equipment, control sensors, etc. The shop drawings shall include elevations from finished floors, dimensions from column lines and routing of services.

- J. The shop drawing must be coordinated and scheduled such that other work in the ceiling spaces, and in mechanical rooms, shall not be initiated until all trades review the shop drawings and provide written indication that they have coordinated around the sheet metal layout. It is strongly recommended that this effort be initiated immediately, by the Contractor, to maintain the construction schedule.
- K. The contractor(s) responsible for the domestic hot and cold water, waste and vent piping, sprinkler piping, electrical conduits, HVAC controls, etc. shall provide marked up contract documents showing coordination around the sheet metal shop drawings. The marked up drawings shall include elevations from finished floors, dimensions from column lines and routing of services.
- L. Shop Drawings will not be reviewed by the Professional of Record (POR) unless they are clearly stamped by the Contractor. Prior to submitting shop drawings, check for dimensional correctness, interferences and conformance to specifications and plans. The Contractor, before issuing for the shop drawings for final review and approval, shall stamp the shop drawings as "Approved" and indicate the date when the Contractor's review has been completed. Contractor shall identify submittal data by project name and equipment identification number.
- M. POR's review of shop drawings shall not relieve the Contractor from responsibility for errors, omissions and other deficiencies or deviations in the shop drawings that do not comply with the requirements of the Contract drawings and specifications.
- N. Shop drawings shall include detailed information for the following:
 - 1. HVAC air distribution system equipment and accessories; including, but not limited to, air handling units, VAV terminal units, grilles, control dampers, etc.
 - 2. HVAC water distribution system equipment and accessories; including, but not limited to, pumps, valves, etc.
 - 3. Plumbing distribution system equipment and accessories; including, but not limited to, waste and vent, greasy waste and vent, hot and cold water, fixtures, etc.
 - 4. Fire protection system equipment and accessories; including, but not limited to, fire pump, sprinklers, control valves, etc.

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION

**SECTION 01 4000
QUALITY REQUIREMENTS**

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. The Owner shall engage and pay for the services of an independent testing laboratory to perform inspections and tests of materials and construction as defined in the General Conditions and indicated in these specifications, except that in the event of a test failure, or failure to notify testing agency of cancelled pour, the Contractor shall pay for any retesting.
- C. Related Requirements:
 - 1. Divisions 02 through 33 Sections for specific test and inspection requirements.

1.03 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.
- 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 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.

1.04 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 Statement: Submit a statement signed and sealed by the responsible design professional, for each product and specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.05 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. In case of conflict between these Contract Documents and the Building Code, the more stringent shall govern.
- 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.

1.06 ACTION SUBMITTALS

- A. Shop Drawings: For mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction. Refer to Divisions 02 through 33 for specific mockup requirements that may apply.
1. Indicate manufacturer and model number of individual components.
 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.07 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. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- D. 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.
- E. Schedule of 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.

F. Reports: Prepare and submit certified written reports and documents specified.

1.08 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.

1.09 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. ALL reports shall be submitted by Testing Agency on www.centerline.co, regardless of whether the testing agency has their own distribution platform. 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.

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9. Test and inspection results and an interpretation of test results.
 - a. Note on Centerline whether test passed or failed.
 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 re-inspecting.
- 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.

1.10 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 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 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 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. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. 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.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 7. 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.

1.11 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. Payment for these services will be made by Owner via separate Contract.
 3. Costs for retesting and re-inspecting 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 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 3000 "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 pre-installation 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 and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Commissioning Authority 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. Laboratory inspector is not authorized to revoke, alter, relax, enlarge, or release any requirement of the Contract Documents or to approve or accept any portion of the work, except where such approval is specifically called for in Specifications.
 6. Comply with all Building Code requirements for "Special Inspection" whether or not such inspections are specified herein.
 7. 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 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.

1.12 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
- B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections and/or Drawings, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority, with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion which includes a list of unresolved deficiencies.

5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 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 reference during normal working hours.

3.02 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 017300 "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.

**SECTION 01 4219
REFERENCE STANDARDS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Divisions 00 and 01 Specification Sections, apply to this Section.

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- 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.
- J. Installer: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - 1. Trades: Use of titles such as "carpentry" is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradepersons of the corresponding generic name.
 - 2. The term experienced, when used with the term installer, means having a minimum of five previous projects similar in size and scope of this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.
 - 3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no choice or option. However, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.

This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

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- K. Testing Agencies: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.03 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's MasterFormat 2004 Version Numbering System.
- B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
1. Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated shall be interpolated as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the Contract Documents so indicates.
 2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
 3. The words "shall be" shall be included by inference wherever a colon (:) is used within a sentence or phrase.

1.04 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.
1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Conflicting Requirements: Where compliance with two or more standards is specified, and the standards may establish different or conflicting requirements for minimum quantities or quality levels. Refer requirements that are different, but apparently equal, and uncertainties to the Architect for a decision before proceeding.
1. 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. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.
- D. 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.
- E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S."

1.05 QUALITY ASSURANCE

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- A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.
- C. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

1.06 GOVERNING REGULATIONS/AUTHORITIES

- A. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents. Contact authorities having jurisdiction directly for information and decisions having a bearing on the the Work.

1.07 SUBMITTALS

- A. Permits, Licenses, and Certificates: For the Owner's records, submit coipes of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgements, and similar documents, correspondence and records established in conjunction with compliance standards and regulations bearing upson performance of the Work.

**SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.03 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, occupants of Project site, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Owner will pay sewer service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Owner will pay water service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Owner will pay electric power service use charges for electricity used by all entities for construction operations.

1.04 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. Submit for local permits as required by the authority having jurisdiction.
- C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements and message content.
- D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- E. 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.
- F. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.

3. Location of proposed air-filtration system discharge.
4. Waste-handling procedures.
5. Other dust-control measures.

1.05 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.
- C. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1. Provide temporary egress at locations as indicated on Drawings.

1.06 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

2.01 MATERIALS

- A. Chain-Link Construction 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 rails.
 1. Install temporary fencing as necessary to secure work areas, for general public safety, and protect Contractor's stored materials and equipment.
- B. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors
- C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.
- D. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches (914 by 1524 mm).
- E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.02 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 the needs of 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 20 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.

7. TV and internet connection for interface with Teams calls and meetings from the project office.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 1. Store combustible materials apart from building.

2.03 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: Owner authorizes use of permanent HVAC system for temporary use during construction, therefore provide filter with MERV of 13 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Division 01 Section "Closeout Procedures."
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 EXECUTION

3.01 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.
 1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."
- 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.
- C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with coordination drawing.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containing devices.
 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.02 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:
 - 1. Install water service and distribution piping in sizes and pressures adequate for construction.
 - 2. Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- 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 and Cooling: Provide temporary heating and cooling 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 ambient and substrate moisture levels to level required to allow installation or application of finishes, and their proper curing or drying.
- 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.
 - 2. Connect temporary service to Owner's existing power source, as directed by Owner.
- 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.
 - 2. ~~Install lighting for Project identification sign.~~
- I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment and one land-based telephone line for each field office.
 - 1. 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.
 - 2. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- J. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.
- K. Project Computer: 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 Core i5 or i7
 - 2. Memory: **[16] [Insert number]** gigabyte.

3. Disk Storage: **[1] [Insert number]** -terabyte hard-disk drive
4. Display: 24-inch (610-mm) LCD monitor with 256-Mb dedicated video RAM
5. Full-size keyboard and mouse
6. Network Connectivity: **[10/100BaseT Ethernet] [Gigabit]**.
7. Operating System: Microsoft Windows 10 Professional.
8. Productivity Software:
 - a. Microsoft Office Professional, 2013 or higher, including Word, Excel, and Outlook
 - b. Bluebeam Revu 21
- L. Internet Service: Broadband modem, router, and ISP, equipped with hardware firewall, providing minimum [10.0] [Insert number] -Mbps upload and [15] [Insert number] -Mbps download speeds at each computer.
- M. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.

3.03 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 Planned 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 operation.
 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 in accordance with Section 312000 "Earth Moving."
- 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: Provide temporary parking areas for construction personnel within limits of project site. Coordinate locations with Owner's representative to minimize interference of Owner's use of the Project site.
- E. Storage and Staging: Use designated areas of Project site for storage and staging needs.
- F. 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.
- G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 1. Identification Signs: Provide Project identification signs. Location of signs to be coordinated at Pre-Construction Conference.
 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.

- H. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- I. 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.
- J. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life:
 - 1. Do not load elevators beyond their rated weight capacity.
 - 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work, so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- K. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas, so no evidence remains of correction work.

3.04 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.
 - 1. Comply with work restrictions specified in Section 011000 "Summary."
- 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 011000 "Summary."
- C. 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 erosion- and sedimentation-control Drawings or if not provided the requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
 - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
 - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection:
 - 1. Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

- 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. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence: Before construction operations begin, 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 or as indicated on Drawings.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
 - 3. Orange fencing not allowed for site enclosure or tree protection.
- 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 Egress: Maintain temporary egress from existing occupied facilities as indicated in drawings and as required by authorities having jurisdiction.
- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
- L. Temporary Partitions: Provide floor-to-deck dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
 - 1. Construct partitions with six (6) inch metal studs at 12" o.c., full batt insulation and gypsum wallboard with joints taped on each side. Metal stud deflection design to be responsibility of metal stud supplier professional engineer licensed in the State of Louisiana.
 - 2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 - 3. Insulate partitions to control noise transmission to occupied areas.
 - 4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 - 5. Protect air-handling equipment.
 - 6. Provide walk-off mats at each entrance through temporary partition.
- M. 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.

3.05 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 Area: 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 Area: 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 Area 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 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 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.06 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. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

**SECTION 01 6000
PRODUCT REQUIREMENTS**

PART 1 GENERAL

1.01 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.

1.02 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 2500 "Substitution Procedures" for requests for substitutions.

1.03 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. Evaluating Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance, and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.

2. Data indicating compliance with the requirements specified in "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements of Section 01 3000 "Submittal Procedures".
- F. Substitution: Refer to Section 01 2500 "Substitution Procedures" for definition and limitations or substitutions.

1.04 ACTION SUBMITTALS

- A. Comparable product requests or substitutions for the Contractor's convenience will not be considered after award of bid unless otherwise indicated.
- B. 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 one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 01 3000 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 3000 "Submittal Procedures." Show compliance with requirements.

1.05 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. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is inconspicuous.
 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed
 - e. Ratings
 3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.06 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

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1.07 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. Provide a secure location and enclosure at Project site for storage of materials and equipment.
 - 2. Store products to allow for inspection and measurement of quantity or counting of units.
 - 3. Store materials in a manner that will not endanger Project structure.
 - 4. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 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.
 - 8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.08 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 and issued in the name of Owner or endorsed by manufacturer to 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. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01 7700 "Closeout Procedures."

1.09 INTEGRITY OF FIRE, SOUND, AND WEATHERPROOF ASSEMBLIES

- A. Spaces formed between fire or sound rated wall, floor, ceiling, or roof assemblies or penetrations through such assemblies by pipe, conduit, ductwork, any other item, or voids

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provided for possible use of any item shall be caulked, grouted, filled, or otherwise protected in a manner to maintain fire or sound ratings.

- B. Where openings or penetrations are subject to moisture or weather, seal openings and penetrations with non-shrink grouts and elastomeric sealants intended for specific application.
 - 1. Seal floor penetrations during construction to prevent water from flowing through building.
 - 2. Where safining and batt insulation are used, protect from moisture. Remove damp material and install new material before enclosing.

PART 2 PRODUCTS

2.01 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: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Products specified with "or equal" provisions will only be considered after award of bid at the discretion of the Architect. Refer to Section 012500 "Substitution Procedures" for requests for "or equal" products.
 - b. Submit additional documentation required by Architect **{through Construction Manager}** in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by Architect, whose determination is final.
- 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 after award of bid unless otherwise indicated.
 - b. Non-restricted 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. Non-restricted 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.
 - c. Comparable products or substitutions for Contractor's convenience will not be considered after award of bid unless otherwise indicated.
- 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.
 - a. Comparable products or substitutions for Contractor's convenience will not be considered after award of bid.
- 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 Division 01 Section "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: 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 both standard and premium items.

2.02 COMPARABLE PRODUCTS

- A. Comparable products or substitutions for Contractor's convenience will not be considered after award of bid unless otherwise indicated.
- B. Conditions for Consideration: 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, 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.
- C. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of request for a comparable product. Architect will notify Contractor of approval or rejection of proposed comparable product within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
- D. Submittal Requirements, Two-Step Process: Approval by Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

- E. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval of Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 EXECUTION

3.01 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and signed to other Work.
 - 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

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**SECTION 01 7250
FIELD ENGINEERING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Divisions 00 and 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. General: This Section specifies administrative and procedural requirements for field engineering services, including, but not necessarily limited to, the following:
 - 1. Land survey work required for layout

1.03 SUBMITTALS

- A. Certificates: Submit a certificate signed by the Land Surveyor or Professional Engineer certifying that the location and elevation of improvements comply with the Contract Documents.

1.04 QUALITY CONTROL

- A. Employ a Land Surveyor registered in the State in which the project is located, and acceptable to Owner to perform land surveying services required.
- B. Instrument Operators: Provide certified instrument operators for laying out work and establishing working points.

PART 2 PRODUCTS (NOT APPLICABLE).

PART 3 EXECUTION

3.01 EXAMINATION

- A. The Owner will identify existing control points and property line corner stakes.
- B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks before proceeding to layout the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.
 - 1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.
 - 2. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.
- C. Establish and maintain a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- D. Existing utilities and equipment: 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.
 - 1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water service piping.

3.02 PERFORMANCE

- A. Working from lines and levels established by the property survey, establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
 - 1. Advise entities engaged in construction activities, of marked lines and levels provided for their use.
 - 2. As construction proceeds, check every major element for line, level and plumb.

- B. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.
- C. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical Work.
- D. Existing Utilities: Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in, or affected by construction. Coordinate with local authorities having jurisdiction.

SECTION 01 7300 EXECUTION

PART 1 GENERAL

1.01 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.

1.02 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. Cutting and patching.
 - 5. Progress cleaning.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.
 - 8. Correction of the Work.
- B. Related Requirements:
 - 1. Section 01 1000 "Summary" for limits on use of Project site.
 - 2. Section 01 3000 "Submittal Procedures" for submitting surveys.
 - 3. Section 01 7700 "Closeout Procedures: for submitting final property survey with Project Record Documents, recording for Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
 - 4. Section 07 0553 "Fire and Smoke Assembly Identification".
 - 5. Section 07 8400 "Firestopping" for patching penetrations in fire-rated construction.

1.03 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.04 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at Project site.
 - 1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect of scheduled meeting. Require representatives of each entry directly concerned with cutting and patching to attend, including the following:
 - a. Contractor's superintendent.
 - b. Trade supervisor responsible for cutting operations
 - c. Trade supervisor(s) responsible for patching of each type of substrate
 - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extend each trade is affected by cutting and patching operations.
 - 2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- B. Layout Conference: Conduct conference at Project site.
 - 1. Prior to establishing layout of new and/or existing perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:
 - a. Contractor's superintendent

- b. Professional surveyor, professional engineer, Contractor's personnel responsible for performing Project surveying and layout.
- c. Professional surveyor, professional engineer responsible for performing site survey serving as basis for Project design.
- 2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
- 3. Review requirements for including layouts on Shop Drawings and other submittals.
- 4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[land surveyor] [professional engineer]**
- B. Certified Surveys: Submit PDF signed by **[land surveyor] [professional engineer]**.
- C. Certificates: Submit certificate signed by **[land surveyor] [professional engineer]**, certifying that location and elevation of improvements comply with requirements.
- D. Cutting and Patching Plan: Submit plan describing procedures at least ten (10) days prior to the time cutting and patching will be performed. Include the following information:
 - 1. Extent: Describe reason for and extend of each occurrence of cutting and patching.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant elements.
 - 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
- E. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.06 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. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Plumbing piping systems.

- f. Mechanical systems piping and ducts.
 - g. Control systems.
 - h. Communication systems.
 - i. Fire-detection and -alarm systems.
 - j. Conveying systems.
 - k. Electrical wiring systems.
 - l. Operating systems of special construction.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
- a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Sprayed fire-resistive material.
 - d. Equipment supports.
 - e. Piping, ductwork, vessels, and equipment.
 - f. Noise- and vibration-control elements and systems.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Comply with requirements specified in other Sections.
 - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.
- C. 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.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Existing Conditions: The existence and location of utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of utilities, mechanical and electrical systems, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, 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

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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.

3.02 PREPARATION

- A. Existing Utility Information: Furnish information to local utility 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 information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.03 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.

3.04 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. 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.
- C. Benchmarks: Establish and maintain a minimum of two 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.
- D. 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. Survey shall indicate all information as required by local, state or federal authorities for finish floor grades to meet local requirements.

3.05 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 90 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. 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.
- H. 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.
- I. 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.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.06 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interface with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 01 1000 "Summary".
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to [minimize] [prevent] interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 2. Pre-Installation Conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.08 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 7419 "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.
- K. During Construction:
 - 1. Oversee cleaning and ensure that building(s) and ground(s) are maintained free of accumulations of waste materials and rubbish.
 - 2. Sprinkle dusty debris with water.
 - 3. During progress of Work, clean-up site and access and dispose of waste materials, rubbish and debris at least once every week.
 - 4. Provide dump containers and locate on site for collection of waste materials, rubbish and debris on a daily basis.
 - 5. Do not allow waste materials, rubbish and debris to accumulate and become an unsightly or hazardous condition.
 - 6. Remove waste materials, rubbish and debris from site and legally dispose of at public or private dumping area.
 - 7. Lower waste materials in controlled manner with as few handlings as possible; do not drop or throw materials from heights.
 - 8. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

3.09 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

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- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 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.

3.11 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

**SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
 - 1. Recycling nonhazardous construction waste.
 - 2. Disposing of nonhazardous demolition and construction waste.
- B. Related Sections include the following:
 - 1. Section 01 5000 "Temporary Facilities and Controls" for environmental-protection measures during construction, and location of waste containers at Project site.
 - 2. Section 04 2000 "Unit Masonry" for disposal requirements for masonry waste.
 - 3. Section 31 1000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.03 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. 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.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.04 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.05 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 50 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 the following:
 - 1. Construction Waste:
 - a. Metals.
 - b. Insulation.
 - c. Carpet.
 - d. Gypsum board.
 - e. Piping.

- f. Electrical conduit.
- g. 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.

1.06 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for the Notice to Proceed describing waste management efforts in accordance with the specified requirements.

1.07 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use [Form CWM-7 for construction waste] [and] [Form CWM-8 for demolition waste] [Insert Owner's form designation]. 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. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. 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.
- G. Qualification Data: For [waste management coordinator] [and] [refrigerant recovery technician].
- H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- I. Refrigerant Recovery: Comply with requirements in [Section 024116 "Structure Demolition"] [Section 024119 "Selective Demolition"] for refrigerant recovery submittals.

1.08 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

- B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of waste management coordinator.
 - 2. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 3. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 4. Review waste management requirements for each trade.

1.09 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis.[Distinguish between demolition and construction waste.] Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 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 5000 "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.[Coordinator shall be present at Project site full time for duration of Project.]
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned within [three] [Insert number] 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 and recycled.
 - 2. Comply with Section 01 5000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
- E. Waste Management in Historic Zones or Areas: Transportation equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by [12 inches (300 mm)] [Insert dimension] or more.

3.02 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

- C. 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.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 2. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 3. Store components off the ground and protect from the weather.
 - 4. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.03 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

3.04 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.

**SECTION 01 7700
CLOSEOUT PROCEDURES**

PART 1 GENERAL

1.01 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.

1.02 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. Repair of the Work.
 - 6. Correction period inspection.
- B. Related Requirements:
 - 1. Section 01 3233 "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Section 01 7300 "Execution" for progress cleaning of Project site.
 - 3. Section 01 7800 "Closeout Submittals" for submitting record Drawings, record Specifications, record Product Data and operation and maintenance manual requirements.
 - 4. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.03 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.04 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.06 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: 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 Substantial Completion: Complete the following a minimum of 10 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 occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction

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- photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Divisions 02 through 33 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.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 5. Submit test/adjust/balance records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 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. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training", and Section 01 7910 "D
 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 10 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. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.07 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 01 2900 "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.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 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 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. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.08 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. Punch list is to be generated with Bluebeam Software, using the Markups List to indicate items on record floor plans.
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 in the following format:
 - a. PDF electronic file, as generated using Bluebeam Software. Architect will return annotated file.

1.09 REINSPECTION PROCEDURES

- A. The Architect will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to Architect.
1. Upon completion of reinspection, the Architect will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 2. If necessary, if additional reinspections are required, the architect/engineer will be reimbursed at a rate of \$150 per hour, including travel time, for all repeated reinspections. The Contractor shall bear all costs related to such, and these costs shall be deducted from those amounts owed the Contractor for the Work.

1.10 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 15 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.
 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
1. Submit to Architect for review by uploading to Centerline.co.
- E. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.11 ADDITIONAL ARCHITECTURAL SERVICES

- A. TAS Inspection Items: If architectural services are required more than 90 calendar days after the date of the TDLR/TAS Inspection Report because of Contractor's delays, the Contractor shall bear all costs related to such delay, and these costs shall be deducted from those amounts owed the Contractor for the Work.
- B. All Other Items (Punch List Re-Inspections, Closeout Document Submittals, etc.): If architectural services are required more than 60 calendar days after the date of Substantial Completion of the Work (as indicated on the Certificate of Substantial Completion) because of Contractor's delays, the Contractor shall bear all costs related to such delay, and these costs shall be deducted from those amounts owed the Contractor for the Work.

1.12 CORRECTION PERIOD INSPECTION

- A. No later than eleven (11) months following the date of substantial completion a Contractor's one-year correction period inspection of the facility shall be conducted by the Contractor for the purpose of reviewing Work believed by the Owner not to be in accordance with the requirements of the Contract Documents. The Contractor, an Owner's representative and the Architect if requested by the Owner shall attend the inspection. The Contractor shall correct to the satisfaction of the Owner all work found to be deficient. Contractor's obligations under this paragraph are in addition to any other obligation, warranty and guaranties furnished in the Contract Documents by the Contractor, the installer or the manufacturer of products, equipment or systems.

PART 2 PRODUCTS

2.01 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

3.01 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 HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
 - q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - r. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 01 5000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 7419 "Construction Waste Management and Disposal."

3.02 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. 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.
 - 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.
4. 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.

**SECTION 01 7800
CLOSEOUT SUBMITTALS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Divisions 00 and 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

1.03 RELATED REQUIREMENTS

- A. Section 01 3000 - Submittal Procedures: Submittals, shop drawings, product data, and samples.
- B. Individual Product Sections: Specific requirements for operation and maintenance data.
- C. Individual Product Sections: Warranties required for specific products or Work.

1.04 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect prior to submission of final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit three sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.
- B. Record Drawings: Furnish and maintain one set of blue- or black-line white prints of Contract Drawings and Shop Drawings for the duration of Construction.
 - 1. 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 prepare the marked-up Record

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Prints. The maintenance of these documents shall be set forth in Specification Section 01 3000 "Submittal Procedures".

- a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - d. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
2. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
 3. At completion of project submit one hard copy "Project Record Drawing" and one CD of "Project Record Drawings" in (pdf) format.
- C. Record Specifications: Furnish and maintain one copy of Project's Specifications, including addenda, contract modifications, and standard contract forms indicated below for the duration of Construction. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications. The maintenance of these documents shall be set forth in Specification Section 01 3000 "Submittal Procedures".
1. General:
 - a. Give particular attention to information on concealed elements that can
 - b. Accurately record information in an understandable drawing technique
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - d. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
 2. Standard Contract Forms (reference Section "Schedule of Standard Contract Forms"):
 - a. Contractor's Affidavit of Payment of Debts and Claims, AIA Document G706.
 - b. Contractor's Affidavit of Release of Liens, AIA Document G706A.
 - c. Consent of Surety to Final Payment, AIA Document G707 (if applicable).
 - d. Certificate of Occupancy.
 - e. Health Permit (if applicable).
 - f. List of subcontractors and major suppliers with addresses and telephone numbers.
 - g. Hazardous Materials Certification Statements.
 - h. Signed letter from Owner for receipt of all extra materials as set forth in the Specifications.
- D. Record Product Data (Shop Drawings): Furnish and maintain one copy of each Product Data submittal, for the duration of Construction. Mark set to indicate the actual product installation where installation varies substantially from that indicated in the Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
 4. At completion of project, submit one hard copy "Record Product Data" and one CD of "Record Product Data" in (pdf) format.
- E. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

3.02 OPERATION AND MAINTENANCE DATA

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- A. Assemble one complete hard copy and one digital set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
1. Operations and Maintenance Data for Materials and Finishes:
 - a. For Each Product, Applied Material, and Finish:
 - 1) Product data, with catalog number, size, composition, and color and texture designations.
 - 2) Information for re-ordering custom manufactured products.
 - b. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
 - c. Moisture protection and weather-exposed products: Include product data listing applicable reference standard, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
 - d. Additional information as specified in individual product specification sections.
 - e. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
 - f. Provide hard copy with a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.
 2. Operation Data for Equipment and Systems:
 - a. Emergency instructions and procedures.
 - b. System, subsystem, and equipment descriptions, including operating standards.
 - c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
 - d. Description of controls and sequence of operations.
 - e. Piping diagrams.
- B. Digital Set:
1. Organizational Structure
 - a. Table of Contents (TOC)
 - 1) Each section of the TOC will be hyperlinked to the first page of each section in the body of the PDF.
 - b. Floor Plans
 - 1) Each level's overall floor plan will be included in section called "Floor Plans" and will be located directly after TOC.
 - c. Project Warranties
 - d. Substantial Completion Certificates
 - e. Subcontractor Directory
 - f. Completion Lists
 - g. Certificate/Temporary Certificate of Occupancy
 - h. RFIs
 - i. Contractor's Affidavit of Payment of Debts and Claims (AIA G706).
 - j. Contractor's Affidavit of Release of Liens (AIA G706A).
 - k. Consent of Surety Company to Release of Liens (G707).
 - l. Hazardous Materials Certification Statement(s).
 - m. Signed Receipt from Owner for Backstock Materials.
 - n. Submittals.
 - 1) All O&M Data are to be broken out by specification section.
 2. All Sections mentioned above to be bookmarked in descending order.
 - a. Bookmarked Specification Sections to be named "Spec # Spec Title".
 - 1) Example: "22 0001 Plumbing Specialties"

3.03 RECORD CAD DRAWINGS

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- A. Record CAD drawings are defined as digital CAD files (in .dwg format) which have been updated to reflect any and all changes that occurred during construction.
- B. Each file is to be broken out by floor and labeled accordingly.

3.04 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

3.05 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
 - 1. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface, or final grade and dress with topsoil, sodding, or seeding if required elsewhere in the Specifications.
- C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

**SECTION 01 7900
DEMONSTRATION AND TRAINING**

PART 1 GENERAL

1.01 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.

1.02 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. Demonstration and training video recordings.
- B. Related Requirements:
 - 1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.03 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit 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.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator and 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.

1.04 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 4000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.
 - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.05 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.

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- 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

2.01 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 including, but not limited to the following:
 - 1. Motorized doors, including overhead coiling door.
 - 2. Equipment, including loading dock equipment, food-service equipment, and residential appliances.
 - 3. Fire-protection systems, including fire alarm and fire-extinguishing systems.
 - 4. Heat generation equipment and distribution piping.
 - 5. Refrigeration systems and distribution piping.
 - 6. HVAC systems, including air-handling equipment, air distribution systems, and terminal equipment and devices.
 - 7. HVAC instrumentation and controls.
 - 8. Electrical service and distribution, including transformers, switchboards, panelboards uninterruptible power supplies, and motor controls.
 - 9. Packaged engine generators, including transfer switches.
 - 10. Lighting equipment and controls.
 - 11. Communication systems, including intercommunication, surveillance and voice and data 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

3.01 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 7800 "Closeout Submittals."
- B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 3. Owner will furnish Contractor with names and positions of participants.
- C. 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, through Architect, with at least seven days' advance notice.
- D. 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.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- F. 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.

**SECTION 01 8000
ELECTRONIC REPORTING/COMMUNICATIONS**

THE GENERAL CONTRACTOR SHALL BE REQUIRED TO HAVE E-MAIL AND WEB ACCESSIBILITY ON THE CONSTRUCTION SITE AND IN THE CONTRACTORS MAIN OFFICE TO ALLOW FOR ELECTRONIC COMMUNICATIONS. CONSTRUCTION SUPERINTENDENT AND THE PROJECT MANAGER SHALL HAVE INDIVIDUAL E-MAIL ADDRESSES FOR USE DURING THE CONSTRUCTION PHASE. NOTE: EMAIL IS ONLY FOR ACCESS TO CENTERLINE, E MAIL SHALL NOT BE USED IN THE EXECUTION OF THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, ALL COMMUNICATION SHALL BE MAINTAINED AND DOCUMENTED THRU CENTERLINE.

1.01 THE ONLY LOGS TO BE PROVIDED, REVIEWED AND ACCEPTED AT THE CONSTRUCTION MEETINGS ARE THOSE LISTED BELOW OBTAINED FROM CENTERLINE. THE GENERAL CONTRACTOR SHALL PROVIDE THE FOLLOWING ITEMS BOTH ELECTRONICALLY AND/OR HARD COPIES AS OUTLINED BELOW:

1.02 DAILY FIELD REPORTS

- A. Daily field reports shall be sent electronically the first working day after the date of the field report. File shall be sent as a PDF and shall be saved in the following method DFR_001_121423_JSC512.PDF, note the numbers in the middle are the report number and the date of the report.

1.03 WEEKLY FIELD REPORTS - FRIDAY

- A. These shall be as Daily Field Reports but shall include a minimum of 10 electronic photographs. These photographs shall be of critical areas and shall be included in the same file as the Field Report.

1.04 REQUEST FOR INFORMATION

- A. Request for Information shall be sent electronically to the Architect. All documents shall be sent in PDF format and saved in the following method RFI_001_JSC512.PDF. Each Request for Information shall be in one file only. Each Request for Information shall be numbered in numerical order.

1.05 APPLICATION FOR PAYMENT

- A. Application for Payment shall be sent in an electronic and hard copy to the Architect. All documents shall be sent in PDF format and saved in the following method, AFP121423_JSC512PDF. Each Application for Payment shall be in one file only.

1.06 SHOP DRAWINGS

- A. Shop Drawings shall be sent electrically to the Architect via www.centerline.co, as per Section 013300. This document is also to be stored electronically at the project site for Architect and Contractor access during construction. All documents shall be sent in PDF format and saved in the following method SD_023000_01_JSC512.PDF. Each Shop Drawing shall have specification number and the submittal number for that specification section. The file above indicates specification section 023000 submittal number one. Upon completion of the project the contractor is to submit four (4) copies on CD of all Shop Drawings during the project closeout phase. These shall be in PDF format.

1.07 OPERATIONS AND MAINTENANCE MANUALS

- A. Operations and Maintenance Manuals shall be sent hard copy to the Architect. After review and approval the Contractor shall submit an electronic copy to the Architect within seven (7) days of receipt of approved manuals. All documents shall be sent in PDF format and saved in the following method CM_023000_01_JSC512.PDF. Each O&M manual shall have specification number and the submittal number for that specification section. The file above indicates specification section 023000 submittal number one. Upon completion of the project the contractor is to submit four copies on CD of the entire O&M manual. These shall be in PDF format.

SECTION 02 4000 DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Building demolition excluding removal of hazardous materials and toxic substances.
- B. Selective demolition of built site elements.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials..

1.03 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store for reuse or turn over to Owner as indicated.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.04 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor for disposal purposes only. The Contractor shall not retain any materials for personal or business use, auction off any materials or items, or bring any materials, including scrap metals, to a salvage yard for re-sale.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of the Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to the Owner.

1.05 PRE-DEMOLITION MEETING

- A. Pre-demolition Conference: Conduct conference at project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 4. Review areas where existing construction is to remain and requires protection.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Vegetation to be protected.
 - 2. Areas for temporary and permanent placement of removed materials.

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- C. Qualification Data: For refrigerant recovery technician, if applicable. Refrigerant recovery technician shall be certified by an EPA-approved certification program.
 - 1. Provide statement of refrigerant recovery signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- D. Engineering Survey: Submit engineering survey of condition of building.
- E. Proposed Protection Measures: Submit report, including Drawings, that indicate the measures proposed for protecting individuals and property, for environmental protection, for duct control and for noise control. Indicate proposed locations and construction of barriers.
- F. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities. Demolition plan, including sequencing, phasing, and site security shall be approved by Owner and Architect prior to commencing with demolition scope.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - a. Include a detailed sequence of selective demolition and removal work, with starting and end dates for each activity. Ensure other buildings on site operations are uninterrupted.
 - b. Include anticipated interruption of utility services and length of time for anticipated interruption.
 - c. Include coordination for shutoff, capping, and continuation of utility services.
 - d. Include overlap of demolition scope sequencing with anticipated new construction scope sequencing.
 - e. Identify phasing and sequencing.
 - f. Identify fencing, signage, and security measures.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures and proposed measures for protection of individuals and property, environmental protection, dust control, and noise control. Indicate locations for protection and construction of barriers.
- G. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Submit prior to demolition work commencing.
- H. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction. Submit a list of items that have been removed and salvaged.

1.07 FIELD CONDITIONS

- A. Owner will occupy portions of site immediately adjacent to selective demolition area. Conduct demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials, whether on-site or off-site, is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

PART 2 PRODUCTS

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2.01 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 EXECUTION

3.01 SCOPE

- A. Remove portions of the building as indicated and as required to complete construction.
 - 1. Demolition of site elements includes but is not limited to sidewalks, sitework as necessary for sub-surface tie-in. Refer to Drawings for full scope of demolition.
 - 2. Demolition of associated structural, civil, electrical, mechanical and plumbing. Refer to Drawings for full scope of demolition.
- B. Remove all paving and curbs as indicated on drawings.
- C. Remove fences and gates within construction limits indicated on drawings, if applicable.
- D. Contractor shall be responsible to field verify and remove all items that are floor, wall, or ceiling mounted as necessary to accommodate the scope of new construction work, whether or not item is specifically noted for removal in the Drawings.
- E. For items indicated or required to be removed which support other items to remain:
 - 1. Where possible, temporarily shore item to remain during selective demolition and installation of new construction work. Protect item from damage to remain throughout construction. Contractor shall document the condition of all existing items to be removed with photographs including their tag number for identification.
 - 2. If item to be supported cannot be shored, Contractor shall tag and catalog item with Building, Room, and wall location from which it was removed. Contractor shall be responsible for taking dimensions for height and distance from adjacent walls so that item can be reinstalled at original location once lower items to be replaced are installed.
 - 3. Any item to remain and damaged as a result of the the Contractor's scope shall be replaced at the Contractor's cost with an identical item. If an identical item is no longer manufactured, Contractor shall submit a proposed substitution of equal or greater value to the damaged item for the Architect and Owner's consideration.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Use of explosives is not permitted.
 - 3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 4. Provide, erect, and maintain temporary barriers and security devices.
 - 5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 7. Do not close or obstruct roadways or sidewalks without permit.
 - 8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.
- D. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.

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- E. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- F. Hazardous Materials:
 - 1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.
- G. Perform demolition in a manner that maximizes salvage and recycling of materials.
 - 1. Dismantle existing construction and separate materials.
 - 2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
- H. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- E. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- F. For Existing Service/Systems to be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be demolished.
 - 1. Prepare building demolition areas by disconnecting, demolishing and removing fire-suppression, plumbing and HVAC systems, equipment, and components indicated on the Drawings to be removed.
 - a. Piping to be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to be Removed and Reinstalled: Disconnect and cap services and remove, clean and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.
 - 2. Cap utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.
- C. Perform cutting to accomplish removals neatly and as specified for cutting new work.
- D. Repair adjacent construction and finishes damaged during removal work.
- E. Patch as specified for patching new work.
- F. Remove temporary barricades and protections where hazards no longer exist.
- G. Protect all existing utilities to remain, piping to remain, hydrants to remain, etc.
- H. Protect all site signage to remain.
- I. Protect all site paving to remain, including parking areas, sidewalks, roadways, concrete pads, etc.
- J. Protect site infrastructure indicated to remain.

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions.
- B. Concrete where neat openings and less risk of damage to remaining concrete is required: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.06 DEBRIS AND WASTE REMOVAL

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction. Recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."
1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

**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, 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. Pile caps
 - 3. Grade beams
 - 4. Foundation walls.
 - 5. Slabs.
- B. This specification section applies to all references in the contract documents to specification section 03 10 00, 03 20 00, or 03 30 00.
- C. Related Sections include the following:
 - 1. Division 31 Section "Earth Moving".

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement. None of the following are allowed in any concrete in this project: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: Submit a design mixture for each concrete mixture, proportioned on the basis of field experience or trial mixtures, or both, as required by ACI 318-14, chapter 26. Evidence of the ability of the proposed mixture to comply with concrete mixture requirements on the Drawings shall be included. The evidence shall be based on field test records or laboratory trial batches. For concrete mixtures with 28-day compressive strengths greater than 5000 psi, test data shall be provided in accordance with criteria of article 4.2.3 of ACI 301. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amount of mixing water to be withheld for later addition at Project site. The amount of water withheld shall not exceed five percent (5%) of the total batch water.

- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing but not limited to bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Reproductions made from contract drawings will not be accepted. Submit one (1) electronic print. Review of shop drawings by the Engineer will be for general compliance with contract documents.

1. For reinforced concrete masonry walls, the shop drawings shall include a plan view layout of all filled cell locations, including filled cell locations above and below openings. Shop drawings shall include coordination of all embedded conduits, pipes, and sleeves within hollow cells of concrete masonry.

- D. Field quality-control test and inspection reports.

- E. The scope of the above submittals shall only include the items covered by this Section. Do not include items covered by other Sections such as site paving product data, site paving design mixtures, or site paving steel reinforcement shop drawings.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site (with video teleconferencing capabilities) and verify acceptable date with Architect and Engineer a minimum of one week prior to scheduling.

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.
2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
3. Contact vapor barrier manufacturer for preinstallation meeting and to coordinate review of the vapor barrier installation either by digital review or in person.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs qualified personnel on the Project, Flatwork Technicians with at least three (3) years experience, Finishers with at least three (3) years experience and a Supervisor with at least ten (10) years experience in concrete finishing and flatwork.

- B. 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.
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, 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. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete for Buildings,"
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 3. ACI 318, "Building Code Requirements for Structural Concrete."
- G. Concrete Testing Service: Owner shall engage (and pay for) a qualified independent testing agency to perform material evaluation tests. Contractor shall engage and pay a qualified independent testing agency to design concrete mixtures.
- H. Materials and installed work may require testing and retesting, as directed by Architect, at anytime during progress of work. Allow free access to material stockpiles and facilities. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.
- I. For all concrete placement events, all steel reinforcement, other embedded items, and formwork shall be set and finalized a minimum of (3) three hours prior to the time of initial concrete placement to allow time for proper observation/inspection by the design team and the testing agency and time for resolution of any discrepancies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops (if required): Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Forms for Exposed 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.
 - a. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Forms for Unexposed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
 - 1. Form foundation elements as indicated on contract documents (typically placed in general notes of the structural plans).
- C. 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.
- D. Chamfer Strips (if required): Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- 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.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
 - 1. All reinforcing bars to be welded shall be ASTM A706, deformed.
- B. Plain-Steel Wire: ASTM A 82.
- C. Deformed-Steel Wire: ASTM A 1064.
- D. Plain-Steel Welded Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed-Steel Welded Wire Reinforcement: ASTM A 1064, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars (if required): ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view or weather where legs of wire bar supports contact forms (or occur within 1-1/2 inches of surface), use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use either of the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I/II unless otherwise acceptable to Architect.
 - 2. Blended Hydraulic Cement: ASTM C 595, Type IL (10), 10% limestone substitution.
- B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 1 inch nominal for regular sand and gravel mixtures.
 - 2. Maximum Coarse-Aggregate Size: 0.5 inch nominal for sand and pea gravel mixtures. Use a #8 stone aggregate gradation per ASTM C 33 for pea gravel aggregate.
 - 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size.
- D. Water: ASTM C 94/C 94M and potable. Clean and not detrimental to concrete.

2.5 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: ASTM C 494/C 494M, Type A.
 - 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 and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc; MiraSTOP.
 - b. CETCO; Volclay Waterstop-RX.
 - c. Concrete Sealants Inc.; Conseal CS-231.
 - d. Greenstreak; Swellstop.
 - e. Henry Company, Sealants Division; Hydro-Flex.
 - f. JP Specialties, Inc.; Earth Shield Type 20.

2.7 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class A, 15 mil minimum. Include manufacturer's recommended adhesive or pressure-sensitive tape. The vapor retarder shall maintain a permeance of less than .01 perms as tested before and after mandatory conditioning tests (per ASTM E 1745 Section 7.1 and sub-paragraphs 7.1.2-5).
 1. Available Products:
 - a. Fortifiber Building Systems Group; Moistop Ultra.
 - b. Meadows, W. R., Inc.; Perminator.
 - c. Raven Industries Inc.; Vapor Block.
 - d. Reef Industries, Inc.; Griffolyn.
 - e. Stego Industries, LLC; Stego Wrap.
 2. Vapor proofing mastic: water vapor transmission rate per ASTM E 96 of 0.3 perms or lower.
 3. Seam tape: must have a water vapor transmission rate of 0.3 perms or lower in accordance with ASTM E 96

2.8 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

- D. Curing compounds must be approved for use with types of floor finishes and sealers/hardeners specified in Contract Documents. Curing compound shall not interfere with bonding of floor covering. The following list of compounds does not indicate acceptance with the floor finishes utilized. Contractor shall only submit for approval curing compounds that are guaranteed not to interfere with bonding of any floor covering. Contractor assumes all responsibility for compliance of curing compounds with respect to this requirement.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Available Products:
 - a. Ashford Formula
 - b. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - c. Burke by Edoco; Aqua Resin Cure.
 - d. ChemMasters; Safe-Cure Clear.
 - e. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
 - f. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
 - g. Euclid Chemical Company (The); Kurez DR VOX.
 - h. Kaufman Products, Inc.; Thinfilm 420.
 - i. Lambert Corporation; Aqua Kure-Clear.
 - j. L&M Construction Chemicals, Inc.; L&M Cure R.
 - k. Meadows, W. R., Inc.; 1100 Clear.
 - l. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
 - m. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
 - n. Tamms Industries, Inc.; Horncure WB 30.
 - o. Unitex; Hydro Cure 309.
 - p. US Mix Products Company; US Spec Maxcure Resin Clear.
 - q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
1. Available Products:
 - a. Ashford Formula
 - b. Anti-Hydro International, Inc.; AH Clear Cure WB.

- c. Burke by Edoco; Spartan Cote WB II.
- d. ChemMasters; Safe-Cure & Seal 20.
- e. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.
- f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
- g. Euclid Chemical Company (The); Aqua Cure VOX.
- h. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
- i. Lambert Corporation; Glazecote Sealer-20.
- j. L&M Construction Chemicals, Inc.; Dress & Seal WB.
- k. Meadows, W. R., Inc.; Vocomp-20.
- l. Metalcrete Industries; Metcure.
- m. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 150E.
- n. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
- o. Tamms Industries, Inc.; Clearseal WB 150.
- p. Unitex; Hydro Seal.
- q. US Mix Products Company; US Spec Hydrasheen 15 percent
- r. Vexcon Chemicals, Inc.; Starseal 309.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips (if required): ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent (if required): ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Reglets (if required): 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.
- E. Dovetail Anchor Slots (if required): Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

- A. Repair Underlayment (if required): 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 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment (if required): 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 MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the 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 mixture designs based on laboratory trial mixtures.
- B. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- C. The design mixtures for all exterior, exposed concrete shall provide a minimum of 4.5 percent entrained air.
- D. 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.
 - a. Do not use high-range water-reducing or super plasticizing admixtures in slabs.
 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, and concrete required to be watertight.
 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

- 5. If more than one admixture is used in a concrete mix, assure that only compatible admixtures are used.
 - 6. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
 - a. This requirement does not apply to lightweight concrete.
 - b. Air content for lightweight concrete shall comply with any fire-rated assembly requirements listed by Architect.
 - E. Maximum W/C Ratio: 0.50 and as required to achieve specified concrete strength.
- 2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS
- A. Design mixes to provide concrete with the properties as indicated on the structural drawings.
- 2.13 FABRICATING REINFORCEMENT
- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- 2.14 CONCRETE MIXING
- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information. The time concrete is unloaded shall be recorded on each batch ticket.
 - 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.
 - 2. Batch ticket information shall include information necessary to calculate total mixing water and the amount of water added by the receiver.
 - B. Project-Site Mixing is not allowed.

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 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 117, ACI 301-10 and ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces. Surface Finish 3.0, Smooth Rubbed Finish. EXPOSED TO VIEW.
 - 2. Class C, 1/2 inch for rough-formed finished surfaces – NOT EXPOSED TO VIEW.
- 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.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. 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 otherwise indicated.
- 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 and secure anchor rods prior to placing of concrete.
 - 3. 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.
 - 4. Install dovetail anchor slots in concrete structures as indicated.
 - 5. Provide additional rebar if required to secure rebar dowels in proper location.
- B. Do not run any mechanical/electrical/plumbing pipes or conduit horizontally through concrete slabs, unless approved by the Engineer. These items shall also not bear continuously along grade beams and shall only cross perpendicular over top of grade beam in the concrete thickness below the slab at isolated locations.

- C. Do not run any mechanical/electrical/plumbing pipes or conduit through concrete footings and/or pile caps, unless approved by the Engineer. All mechanical/electrical/plumbing items shall be routed to avoid conflicts with concrete construction.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, 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.
 - 1. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- 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. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
 - 1. If vapor barrier is installed before the grade beam pour, seal vapor barrier to the inside face of grade beams along the entire vapor barrier perimeter using tape with a surface that creates a mechanical seal to freshly-placed grade beam concrete, per manufacturer's instructions. Vapor barrier shall be Stego-Wrap 15 mil or approved equal.
 - 2. If vapor barrier is installed after the grade beam pour, seal vapor barrier to the inside face of grade beams along the entire vapor barrier perimeter using tape and termination bar per manufacturer's instructions. Ensure the grade beam surface is clean and dry prior to adhering tape.
 - 3. Lap joints 12 inches and seal with manufacturer's recommended tape.
 - 4. Repair damaged areas by cutting patches of required vapor retarder, overlapping damaged area 12 inches and taping all four sides with approved tape.
 - 5. Seal all penetrations (including pipes) per manufacturer's instructions.
 - 6. The vapor retarder shall be sealed at the perimeter with manuf. approved tape.

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 that would reduce bond to concrete.

- 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.
 - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Maximum spacing of bar supports for slab/mat reinforcement shall be 48 inches on center or less as required to secure reinforcement during construction operations.
- E. Precast concrete blocks shall only be used to support reinforcement from the ground. Concrete blocks shall not be used for support of top reinforcement in concrete slabs or mats.
- F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- G. Install bar reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap ends of bars as indicated on the structural contract drawings.
- H. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces as specified on drawings or a minimum of two full mesh if not otherwise specified. Offset laps of adjoining widths to prevent continuous laps in either direction.

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. Do not continue reinforcement through sides of strip placements of floors and slabs (unless noted otherwise on drawings).
 - 2. Form joints as indicated on drawings. Do not use metal keyways
 - 3. Locate joints for beams, slabs, joists, 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. Space vertical joints in walls as indicated. 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, where indicated on drawings.
 - 7. Construction joints shall not be placed in any slab areas with floor coverings prone to cracking, unless written approval is provided the Architect. When construction joints are allowed in slab areas with floor coverings prone to cracking, the contractor shall assure that joints are properly considered in floor covering installation as required to prevent reflective cracking.
- C. 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. 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 7 Section "Joint Sealants," are indicated.
 2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- D. Doweled Joints (as indicated on drawings): Install dowel bars and support assemblies at joints where indicated.

3.7 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.
1. Place at locations indicated on plans.
 2. Place at concrete construction joints below site grade in order to avoid water intrusion into interior space.
 - a. Place at wall to slab (or mat foundation) joints below site grade.
 - b. Place at wall to wall joints below site grade.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
1. All embedded items, including anchor bolts, rebar dowels, etc., shall be set prior to placement of concrete.
 2. For foundation elements, verify that water is not present in the excavation prior to placement of concrete.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 and in accordance with ASTM C94.
1. Determine initial slump prior to any water addition at Project site and before any significant concrete discharge.
 2. Measure and record water added on Project site and resulting slump.
 3. The amount of water added shall not exceed the amount allowed in the approved design mixture.
 4. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
 5. Do not exceed specified W/C ratio or slump per approved design mixture.

6. Do not add water to concrete delivered in equipment not acceptable for mixing.
 7. Do not add water if more than 0.25 cubic yards of concrete has already been discharged from the mixer.
 8. All water added shall be under the pressure and direction of flow required to achieve uniformity in concrete. Immediately after addition of water, the drum or blades of the truck mixer or agitator shall be turned an additional 30 revolutions or more if necessary, at mixing speed, until uniformity of concrete is achieved.
- C. 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.
- D. 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.
- E. 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 place concrete when temperature is 36 deg F or below or if temperature is expected to reach 36 deg F (or below) within 12 hours of the anticipated time for completing a concrete pour.

3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 4. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301, ACI 305R, 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.
- G. All elevated concrete slabs in unshored construction (e.g. decks over non-composite steel beam and/or joist systems) shall be placed to a constant thickness matching the thickness indicated on the Drawings.
- H. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: (For formed concrete surfaces not exposed to view) As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: (For formed concrete surfaces exposed to view) 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, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Unless noted otherwise, all exposed concrete surfaces shall receive a rubbed finish. Consult with Project Architect to determine the type of rubbed finish prior to pouring of concrete. Apply one of the following to smooth-formed finished as-cast concrete as indicated or directed by Architect:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. 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.

3.10 FINISHING FLOORS AND SLABS

- A. General:
 1. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
 2. See architectural drawings for slab finish requirements or consult the Project Architect if finishes have not been supplied on the architectural drawings.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.
 1. Apply scratch finish to surfaces to receive concrete floor toppings and to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 1. Apply float finish to surfaces indicated, to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. 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, 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.
 - a. Finish surfaces to the following tolerances, see structural drawings
- E. 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.
- F. 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.
 2. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.
- G. 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 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.

3.11 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 the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. 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 from manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTING 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.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.13 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 one month(s). 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, unless noted otherwise in documents. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 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 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 in any dimension in solid concrete, but not less than 1 inch 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 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 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 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 a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture 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 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.

3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Provide special inspections in accordance with Chapter 17 of the International Building Code for concrete construction.
- B. Inspections:
1. Steel reinforcement placement.
 2. Verification of use of required design mixture.
 3. Mixing and delivery time for concrete.
 - a. Record the time batched, time arrived, and the time unloaded for each batch of concrete.
 4. Concrete placement, including conveying and depositing.
 5. Curing procedures and maintenance of curing temperature.
 6. 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.
 - 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 discharge 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 or is questionable.
 - a. Determine initial slump prior to any water addition to concrete at Project site and before any significant concrete discharge.
 - b. Measure and record water added to concrete on Project site and resulting slump.
 - c. Record amount of water indicated on batch ticket allowed to be added.
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. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure five standard cylinder specimens for each composite sample.
 - b. Testing Agency shall be responsible for providing curing container for composite samples on Site as required for initial curing period and verifying that standard-cured composite samples are cured in accordance with ASTM C31/C31M. Testing Agency shall document method of initial curing.
 - c. The Contractor shall provide secured space, electrical power, and access for initial curing of test specimens.
7. Compressive-Strength Tests: ASTM C 39/C 39M.
 - a. Test one specimen at 7 days, three specimens at 28 days, and hold one specimen for testing at 56 days, if necessary.
 - b. A compressive-strength test shall be the average compressive strength from a set of three specimens obtained from same composite sample and tested at age indicated.
8. 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.

9. Test results shall be reported in writing to Architect, 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 (illustrated via highlighting of elements on structural plans), design compressive strength at 28 days, concrete mixture proportions and materials, concrete unit weight, compressive breaking strength, and type of break for both 7- and 28-day tests. Deviations from the requirements of the Contract Documents shall be clearly identified and described on the reports.
 10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect 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.
- D. Measure floor and slab flatness and levelness, per requirements on drawings, according to ASTM E 1155 within 72 hours of finishing.

END OF SECTION 03 30 00

**SECTION 03 3501
CONCRETE INTERIOR FINISHING**

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Single application cure-seal-hardener for all new exposed concrete floors.
 - 2. Precautions for avoiding staining concrete before and after installation.

1.02 REFERENCES

- A. ASTM International:
 - 1. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 2. ASTM C 779 - Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
 - 3. ASTM C 805 - Standard Test Method for Rebound Number of Hardened Concrete.
 - 4. ASTM C 1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
 - 5. ASTM D 3359 - Standard Test Methods for Measuring Adhesion by Tape Test.

1.03 SUBMITTALS

- A. General: Submit listed submittals in accordance with conditions of the Contract and Section 01 3000 - Submittals.
- B. Product Data: Submit product data, including manufacturer's data sheets, installation instructions and technical bulletins for specified products.
- C. Certificates: Manufacturer's certification that the installer is acceptable.
- D. Maintenance Data: Maintenance instructions, including precautions for avoiding staining after application.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Acceptable to the manufacturer.
- B. Regulatory Requirements: In accordance with Section 01 4000 - Quality Control.

1.05 DELIVERY, STORAGE AND HANDLING

- A. General: Comply with Division 1, Section 01 6000 - Product Requirements.
- B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
- D. Handling: Protect materials from dirt, corrosion, oil, grease and other contaminants.

PART 2 PRODUCTS

2.01 SEALED CONCRETE (SC-1)

- A. Manufacturers:
 - 1. Curecrete Distribution, Inc. 1203 W. Spring Creek Place, Springville, UT 84663-0551; Ph. (800) 998-5664; www.ashfordformula.com
 - 2. Or approved equal
- B. Basis of Design Product:
 - 1. Cure-Seal Hardener: Ashford Formula, a water-based chemically reactive penetrating sealer and hardener that seals by densifying concrete so that water molecules cannot pass through but air and water vapor can, and allows concrete to achieve full compressive strength, minimizing surface crazing and eliminating dusting.

- a. Abrasion Resistance to Revolving Disks: At least a 32.5% improvement over untreated samples when tested in accordance with ASTM C 779.
- b. Surface Adhesion: At least a 22% increase in adhesion for epoxy when tested in accordance with ASTM D 3359.
- c. Hardening: As follows when tested in accordance with ASTM C 39:
- d. After 7 days: An increase of at least 40% over untreated samples.
- e. After 28 days: An increase of at least 38% over untreated samples.
- f. Coefficient of Friction: 0.86 dry, 0.69 wet when tested in accordance with ASTM C 1028.
- g. Rebound Number: An increase of at least 13.3% over untreated samples when tested in accordance with ASTM C 805.
- h. Light Exposure Degradation: No evidence of adverse effects on treated samples when tested in accordance with ASTM G 23.

2.02 PRODUCT SUBSTITUTIONS

- A. Substitutions: Substitutions in accordance with Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.02 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared and are suitable for application of product.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.03 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Do not use frozen material. Thaw and agitate prior to use.
- D. If construction equipment must be used for application, diaper all components that might drip oil, hydraulic fluid or other liquids.

3.04 INSTALLATION

- A. New Concrete: Apply cure-seal-hardener to new concrete as soon as the concrete is firm enough to work on after troweling; with colored concrete, wait a minimum of 30 days before application.
 - 1. Spray on at rate of 200 ft²/gal.
 - 2. Keep surface wet with cure-seal-hardener for a minimum soak-in period of 30 minutes without allowing it to dry out or become slippery. In hot weather, slipperiness may appear before the 30 minute time period has elapsed. If that occurs, apply additional cure-seal-hardener as needed to keep the entire surface in a non-slippery state for the first 15 minutes. For the remaining 15 minutes, mist the surface as needed with water to keep the material in a non-slippery state. In hot weather conditions, follow manufacturer's special application procedures.
 - 3. When the treated surface becomes slippery after this period, lightly mist with water until slipperiness disappears.
 - 4. Wait for surface to become slippery again, and then flush entire surface with water to remove all cure-seal-hardener residue.
 - 5. Squeegee surface completely dry, flushing any remaining slippery areas until no residue remains.

6. Wet vacuum or scrubbing machines can be used in accordance with manufacturer's instructions to remove residue.

3.05 PROTECTION

- A. Protect installed floors for at least 3 months until chemical reaction process is complete.
 1. Do not allow traffic on floors for 3 hours after application.
 2. Do not allow parking of vehicles on concrete slab.
 3. If vehicles must be temporarily parked on slab, place drop cloths under vehicles during entire time parked.
 4. Do not allow pipe cutting using pipe cutting machinery on concrete slabs.
 5. Do not allow temporary placement and storage of steel members on concrete slabs.
 6. Clean up spills immediately and spot-treat stains with degreaser or oil emulsifier.
 7. Clean floor regularly in accordance with manufacturer's recommendations.

SECTION 04 2000 UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Clay facing brick.
- C. Mortar and grout.
- D. Reinforcement and anchorage.
- E. Lintels.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section : Loose steel lintels.
- B. Section 07 2100 - Thermal Insulation: Insulated Sheathing
- C. Section 07 2100 - Thermal Insulation: Insulation for cavity spaces.
- D. Section 07 2726 - Fluid Applied Non-Permeable Air Barrier.
- E. Section 07 6200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- F. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2025a.
- C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.
- D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- E. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.
- F. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2023.
- G. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2025.
- H. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2024.
- I. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025a.
- J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.
- K. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.
- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).
- B. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).
- C. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

- A. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- B. Shop Drawings:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
 - 3. Control and expansion joints: Layout exact locations of control and expansion joints on a building plan. Submit detail of control & expansion joints.
 - 4. Head and jamb details at openings in masonry, with associated control or expansion joints.
- C. Samples:
 - 1. Brick Units
 - 2. Colored Mortar
 - 3. Weep vents
 - 4. Pigmented or color mortar sample, mixed with same sand and mortar ingredients to be used on the project.
- D. Manufacturer's Certificates: Certify that masonry units meet or exceed specified requirements.
 - 1. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - 2. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - 3. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing according to ASTM C 67 or a list of addresses of buildings in Project's area where proposed brick has been used successfully and with a history of durability.
 - 4. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 5. Cementitious materials. Include name of manufacturer, brand name, and type.
 - 6. Mortar admixtures.
 - 7. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 8. Grout mixes. Include description of type and proportions of ingredients.
 - 9. Reinforcing bars.
 - 10. Joint reinforcement.
 - 11. Anchors, ties, and metal accessories.
- 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.
 - 3. Include requirements of Section Cast in Place Concrete, for required mix design.
- F. Cold Weather and Hot Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.
- G. Informational Submittals
 - 1. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

- a. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

1.06 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
 - 1. Maintain one copy of each document on project site.
- B. Fire Rated Assemblies: Conform to applicable code for UL Assembly No. as indicated or required.

1.07 MOCK-UPS

- A. Construct a masonry wall as a mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up.
- B. Locate where directed.
- C. Build mockup of typical wall area as shown on Drawings.
- D. Build mockups for each type of exposed unit masonry construction, typical exterior wall, typical interior wall typical exterior and interior walls] in sizes approximately 96 inches (2400 mm) long by 72 inches (1800 mm) high by full thickness, including face and backup wythes and accessories.
 - 1. Include a sealant-filled joint at least 16 inches (400 mm) long in each mockup.
 - 2. Include lower corner of window opening, and upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
 - 3. Include through-wall flashing installed for a 24-inch (600-mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
 - 4. Include metal studs, sheathing, water-resistive barrier, sheathing joint-and-penetration treatment, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes or vents in exterior masonry-veneer wall mockup.
 - 5. Include clay face brick on one face of interior unit masonry wall mockup.
- E. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
- F. Protect accepted mockups from the elements with weather-resistant membrane.
- G. 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.
 - 1. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - 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.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
- B. 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.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- E. 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.
- F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.09 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. Increase extent of cover in first subparagraph below as needed to suit local climatic conditions.
 - 2. Extend cover a minimum of 24 inches (600 mm) down both sides of walls, and hold cover securely in place.
 - 3. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) 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.

1.10 HOT-WEATHER REQUIREMENTS:

- A. Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1.11 COLD-WEATHER REQUIREMENTS:

- A. 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.
- B. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. Masonry Units: Obtain exposed masonry veneer units of a uniform texture and color, or a uniform blend within ranges accepted for these characteristics.
- C. Cementitious Materials: Obtain cementitious ingredients of a uniform quality, including color, for each component.

2.02 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in standard. Do

not install units where defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in completed Work or will impair quality of completed masonry veneer.

- B. Special Shapes: Provide shapes indicated and as follows for each form of masonry unit required:
 - 1. For applications requiring units of form, color, texture, and size on exposed surfaces that cannot be produced by sawing standard unit sizes.
 - 2. For applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - 3. For applications where stretcher units cannot accommodate special conditions including those at corners, movement joints, bond beams, sashes, and lintels.
 - 4. For units without cores or frogs and with exposed surfaces finished for ends of sills, caps, and similar applications that would otherwise expose unfinished unit surfaces.

2.03 CONCRETE MASONRY UNITS

- A. Manufacturers:
 - 1. 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.
 - 2. 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.
- B. Unit Masonry General:
 - 1. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
 - 2. 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 and will be within 20 feet (6 m) vertically and horizontally of a walking surface.
 - 3. See BIA Technical Notes 16B and NCMA TEK 7-3 for information on determining fire-resistance ratings of masonry walls.
 - 4. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - a. Retain subparagraph below if required by authorities having jurisdiction.
 - b. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.
- C. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations.
 - 2. Special Shapes: Provide nonstandard blocks configured for corners.
 - 3. Load-Bearing Units: ASTM C90, lightweight. (Re: Structurel for locations of load bearing units).
 - a. Hollow block, as indicated.
 - b. Unit compressive strength: Provide units with minimum average net area compressive strength of 2,800 psi.
 - c. Density Classification: Lightweight (less than 105 PSF)
 - d. Exposed Faces: Manufacturer's standard color and texture where indicated.
 - 4. Nonloadbearing Units: ASTM C129.
 - a. Hollow block, as indicated.
 - b. Lightweight.
 - 5. Masonry Lintels:
 - a. 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. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.04 BRICK UNITS

- A. Product Quality Standard: ASTM C 216 or ASTM C 652, Grade SW, Type FBS.
 - 1. Unit Compressive Strength: Minimum 3000 psi (20.7 MPa) for average of 5 bricks, and 2500 psi (17.2 MPa) for individual brick, gross area, according to ASTM C 67, Section 7.
 - 2. Hot and Cold Water Testing:
 - a. Water Absorption: Maximum 17.0 percent for average of 5 bricks, and 20.0 percent for individual brick, according to ASTM C 67, Section 8 for 5 hour boiling test.
 - b. Saturation Coefficient: Maximum 0.78 for average of 5 brick, and 0.80 for individual brick.
 - c. Requirement Waivers:
 - 1) Absorption: Saturation coefficient requirement may be waived if there is maximum 8.0 percent absorption of random sampling of 5 bricks according to ASTM C 67, Section 8 for 24 hour submersion test.
 - 2) Freezing and Thawing: Water absorption and saturation coefficient requirements may both be waived if there is maximum 0.5 percent loss in dry weight of any individual brick according to ASTM C 67, Section 9, for 50 cycles of freezing and thawing.
 - 3. Initial Rate of Absorption: Between 5 and 25 g/m per 30 sq in (0.02 sq m) according to ASTM C 67, Section 10. Use of coating to establish initial rate of absorption is not permitted and will not be allowed.
- B. Basis of Design Products:
 - 1. Brick Veneer: TBD, Contractor to submit options within budgetted price range for Architect's approval, Color: To Match Architect's Sample
 - 2. Approved equals shall be submitted by Contractor for review by Architect.
- C. Approved Distributors/Suppliers:
 - 1. Cocreham Brick & Stone, Inc.
 - 2. McConnell Brick & Block Company, Inc.
 - 3. Acme Brick Company
 - 4. Economy Brick Sales, Inc.
 - 5. Or prior approved equal.
- D. Manufacturers:
 - 1. Boral Bricks, Inc: www.boralbricks.com.
 - 2. General Shale Brick: www.generalshale.com.
 - 3. Meridian Brick LLC; _____: www.meridianbrick.com/#sle.
 - 4. Basis of Design: Acme Brick: www.brick.com.
 - 5. Cherokee Brick: www.cherokeebrick.com.
 - 6. Or Approved Equal
- E. Brick Veneer: ASTM C216, Type FBS Smooth, Grade SW.
 - 1. Color and texture: Steele Gray – Modular – Velour.
 - 2. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet.
 - 3. Size: Bricks manufactured to the following actual dimensions within tolerances specified in ASTM C 216.
 - a. Actual size: 3-5/8" X 7-5/8" X 2-1/4".
 - 4. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
 - 5. Unit Compressive Strength: 3000 psi (20.7 MPa), measured in accordance with ASTM C67.

6. Initial Rate of Absorption: Between 5 and 20 g/30 sq. in. per minute when tested per ASTM C 67.
7. Application: Use where brick is exposed, unless otherwise indicated.

2.05 MORTAR AND GROUT MATERIALS

- A. 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.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Mortar Aggregate: ASTM C144.
 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 (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) 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.
- D. Grout Aggregate: ASTM C404.
- E. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
 1. Color(s): TBD.
 2. Manufacturers:
 - a. Davis Colors; True Tone Mortar Colors: www.daviscolors.com.
 - b. Solomon Colors; SGS Mortar Colors: www.solomoncolors.com.
- F. Water: Clean and potable.
- G. 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.

2.06 REINFORCEMENT AND ANCHORAGE

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- C. Manufacturers:
 1. Dur-a Wall: a Hohmann & Barnard, Inc. company; D/A 810, D/A 812 or D/A 817: www.h-b.com/sle.
 2. WIRE-BOND: Core lock rebar positioner, www.wirebond.com.
 3. Heckman Building Products, Inc.: No. 376 Rebar Positioner
 4. Lock Rite: Rebar Positioner
- D. Masonry Joint Reinforcement: General ladder type complying with ASTM A 951/A 951M
 1. Description: Prefabricated ladder type only welded wire units deformed continuous side rods and transverse rods.
 2. Exterior walls: Hot dipped galvanized steel.
 3. Interior Walls: Hot-dipped galvanized steel.
 4. Wire size for side rods: 0.187 inch dia.;
 5. Wire size for cross rods: 0.187 inch dia.
 6. Spacing for Cross Rod: Not more than 16 inches o.c.

7. Provide in heights of not less than 10 feet, with prefabricated corner and tee units.
- E. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- F. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure.
- G. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch (16 mm) of mortar coverage from masonry face.
 1. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch (6.3 mm) thick, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
- H. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
 3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).
- I. Miscellaneous Anchors:
 1. Anchor bolts: Headed steel bolts complying with ASTM A 307, Grade A, with ASTM A563 hex nuts and where indicated, flat washers, hot dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated or required.
 - a. Also refer to structural drawing and specifications.
- J. Postinstalled Anchors:
 1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry, and four times the total imposed load when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 2. 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.
 3. Material where exterior locations and where stainless steel indicated: Alloy Group 1 stainless steel bolts, ASTM F 593 and nuts ASTM F 594.
 4. Also refer to requirements of structural drawing and specifications.

2.07 FLASHINGS

- A. Stainless Steel/Polymer Fabric Flashing: ASTM A240/A240M; 2 mil (0.05 mm) type 304 stainless steel sheet bonded on one side to one sheet of polymer fabric.
 1. Manufacturers:
 - a. Hohmann & Barnard, Inc; Mighty-Flash Stainless Flashing: www.h-b.com/#sle.
 - b. WIRE-BOND; _____: www.wirebond.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- B. Termination Bars: Stainless steel; compatible with membrane and adhesives.
 1. Manufacturers:
 - a. Hohmann & Barnard, Inc; _____: www.h-b.com/#sle.
 - b. Mortar Net Solutions; Termination Bars: www.mortarnet.com/#sle.
 - c. York Manufacturing, Inc; Termination Bar: www.yorkmfg.com/#sle.

2.08 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 one of the following unless otherwise indicated:
 - 1. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Strips, full depth of cavity and 10 inches (250 mm) high, with dovetail-shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

2.09 MASONRY CLEANERS

- A. Verify acceptability of cleaner for cleaning masonry with pigmented mortar joints and for types of masonry units specified.
- B. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surface of type indicated below without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. For masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface-acting acids, chelating, and wetting agents.
 - 2. For dark-colored masonry not subject to metallic-oxidation stains, use formulation consisting of a liquid blend of surface-acting acids and special inhibitors.
 - 3. For masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic and inorganic acids and special inhibitors.
 - 4. Products: Subject to compliance with requirements, provide one of the following:
 - a. 202 New Masonry Detergent; Diedrich Technologies, Inc.
 - b. 200 Lime Solv; Diedrich Technologies, Inc.
 - c. 202V Vana-Stop; Diedrich Technologies, Inc.
 - d. Sure Klean No. 600 Detergent; ProSoCo, Inc.
 - e. Sure Klean No. 101 Lime Solvent; ProSoCo, Inc.
 - f. Sure Klean Vana Trol; ProSoCo, Inc.

2.10 MASONRY SEALERS

- A. Verify acceptability of sealer for compatibility with specified masonry with masonry manufacture prior to installation.
- B. Silane-Siloxane Water Repellent: Breathable, water based silane siloxane water repellent sealer that penetrates into the surface where it chemically reacts to form a hydrophobic barrier within the pores.
 - 1. Manufacturers:
 - a. Basis of Design Product: Armor SX5000 WB (water based) Concrete Sealer
 - b. W.R. Meadows IntraGuard
 - c. Seal-Krete
 - d. Sika Corporation
 - e. Or Approved Equal
 - 2. Coats: 1 Coat minimum
 - 3. Color: Clear, transparent, non-staining.
 - 4. Sheen: No gloss or shine

2.11 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. Use portland cement-lime mortar unless otherwise indicated.
 - 3. For exterior brick and block masonry, use masonry cement or mortar cement mortar.
 - 4. For reinforced masonry, use masonry cement or mortar cement mortar.
 - 5. 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: ASTM C270, using the Proportion Specification.
 - 1. Masonry below grade and in contact with earth: Type M.
 - 2. Exterior, loadbearing masonry: Type M.
 - 3. Exterior, non-loadbearing masonry: Type N.
 - 4. Exterior, thin brick thick set: Type N.
 - 5. Interior, loadbearing masonry: Type M.
 - 6. Interior, non-loadbearing masonry: Type O.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - 1. Pigments shall not exceed 10 percent of portland cement by weight.
 - 2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
 - 3. Mix to match Architect's sample.
 - 4. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Clay face brick.
- 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 requirement on drawings.
 - 3. Provide grout with a slump as indicated on drawings as measured according to ASTM C 143/C 143M.

PART 3 EXECUTION

3.01 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.

3.02 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.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Retain "Wetting of Brick" Paragraph below for high-suction brick. A simple test to determine if wetting is required consists of drawing a circle the size of a quarter on a brick and placing 20 drops of water in the circle; if water is absorbed within 1-1/2 minutes, the brick requires wetting.
- H. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.03 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 (12 mm) or minus 1/4 inch (6 mm).
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) 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 (6 mm in 3 m), or 1/2-inch (12-mm) 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
 - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
 - 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
 - 7. If using Type FBS Rough brick or Type FBA brick, revise tolerance in subparagraph below to allow for variation in brick size.
 - 8. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.
- C. Joints:
 - 1. If using Type FBS Rough brick or Type FBA brick, revise tolerances in five subparagraphs below to allow for variation in brick size. Consider restricting tolerances if Type FBX brick is used.
 - 2. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
 - 3. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).

4. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). [Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).]
6. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.04 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 in running bond; do not use units with less-than-nominal 4-inch (100-mm) 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 4 inches (100 mm). Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) 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. Revise first paragraph below if flexible perimeter joint or thermal break is required.
- G. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

3.05 MORTAR BEDDING AND JOINTING

- A. Lay hollow 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. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- E. Cut joints flush where indicated to receive waterproofing, cavity wall insulation, and air barriers, unless otherwise indicated.
- F. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
 1. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes, tab-type reinforcement.

2. 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.
- G. Header Bonding: Provide masonry unit headers extending not less than 3 inches (76 mm) into each wythe. Space headers not more than 8 inches (203 mm) clear horizontally and 16 inches (406 mm) clear vertically.
 - H. Bond wythes of composite masonry together using bonding system indicated on Drawings.
 - I. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
 - J. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.
 1. Provide continuity with masonry-joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.
 - K. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown or required at juncture, bond walls together as follows:
 1. Retain one of three subparagraphs below and revise to suit Project. If more than one type of bonding is required, revise subparagraphs and show locations of each on Drawings.
 2. Provide individual metal ties not more than 16 inches (406 mm) o.c.
 3. Provide continuity with masonry-joint reinforcement by using prefabricated T-shaped units.
 4. Provide rigid metal anchors not more than 24 inches (610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.06 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
 1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 2. Embed connector sections and continuous wire in masonry joints.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally, with not less than one anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.
- B. Provide not less than 2 inches (50 mm) of airspace between back of masonry veneer and face of sheathing or insulation.
 1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.07 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
 1. Space reinforcement not more than 16 inches (406 mm) o.c.
 2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings[in addition to continuous reinforcement].
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at corners by using prefabricated L-shaped units.

- D. Retain last paragraph above or option in paragraph below.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.08 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
 - 1. Provide an open space not less than 1/2 inch (13 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure. As indicated on structural drawings.

3.09 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 as follows:
 - 1. Install preformed control-joint gaskets designed to fit standard sash block.
 - 2. 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.
- C. Form expansion joints in brick as follows:
 - 1. Build in compressible joint fillers where indicated or required.
 - 2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Section 07 9200 "Joint Sealants."
- D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 9200 "Joint Sealants," but not less than 3/8 inch (10 mm).
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.
- E. If location of control and expansion joints is not indicated on drawings, place vertical joints at 30' O.C., locate control joints at points of natural weakness of masonry work.
 - 1. Locate additional control joints as follows:
 - a. At changes in wall height.
 - b. At intersecting walls forming a T or cross shape, (but not in all wall corners).
 - c. The corners of wall openings, (including window and door openings).
 - 1) Control joint is only required at one side of opening less than 15 feet in width unless otherwise noted.

3.10 LINTELS

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.
 - 1. See general notes on structural drawings for additional requirements.

3.11 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. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated. Install cavity vents at top and bottom of wall to allow for air ventilation at 16" O.C.
- 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 (200 mm)], and through inner wythe to within 1/2 inch (13 mm) 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 (50 mm) on interior face.
 3. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), and 1-1/2 inches (38 mm) into the inner wythe. Form 1/4-inch (6-mm) hook in edge of flashing embedded in inner wythe.
 4. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under water-resistive barrier or air barrier, lapping at least 4 inches (100 mm). Fasten upper edge of flexible flashing to sheathing through termination bar.
 5. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
 6. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 9200 "Joint Sealants" for application indicated.
 7. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 9200 "Joint Sealants" for application indicated.
 8. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
 9. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
 10. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
- D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- E. 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/cavity vent holes.
 2. Space weep holes 16 inches o.c. unless otherwise indicated.
- F. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches (50 mm), to maintain drainage.
- G. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form cavity vents.

3.12 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 48 inches (1520 mm).

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will 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 B 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 2000 sq. ft. (464 sq. m) 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. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- I. 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. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.15 MASONRY SEALER INSTALLATION

- A. Install masonry sealer in accordance with manufacturer's written instructions.
- B. Surface Preparation: Protect all surrounding surfaces, including people, vehicles, property, plants and surfaces other than the masonry to which sealer is to be applied from product, splash, residue and wind drift. Surfaces must be structurally sound, clean and free from dirt, bitumen, efflorescence, oil, curing compounds, form oil, and other foreign matter. Masonry joints must be checked and repointed where necessary. All wall and roof flashings, caulking, and sealants must be in good condition and the surface fully cured and thoroughly dry before application. Apply only when surface is clean and thoroughly dried as excessive moisture inhibits penetration, reducing the service life and performance of the treatment. Moisture content must not exceed 4%. Test for compatibility prior to full application.
- C. Sealer shall not be applied until masonry has been completely installed for a minimum of 30 days.
- D. Sealer shall be installed only when surface and air temperature is 40° F (4 °C) and rising and 95° F (35° C) and falling during application. If freezing conditions exist before application, let surface to receive treatment thaw. Hot, windy conditions will evaporate the water carrier, reducing penetration and performance. On hot, windy days, apply early in the day and in shade, if possible.
- E. Test Application: Perform a test application on the mock-up for proper penetration on each type of surface prior to full-scale application to determine suitability and final appearance. Test using the recommended application instructions. Let area dry thoroughly before inspection.
- F. Do not dilute or alter product. Mix thoroughly prior to use. Do not freeze product.
- G. Protection: Protect surfaces from rainfall for six hours following treatment. If rainfall occurs and surface turns white, thoroughly flush surface and reapply product when dry.
- H. Clean-up: Clean tools, equipment and overspray immediately with soap and warm water.

3.16 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. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 1. Crush masonry waste to less than 3 inches (100 mm) in each dimension.
 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. 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.

**SECTION 04 7200
CAST STONE MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural cast stone.
- B. Units required are:
 - 1. Caps..

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications
- B. Section 04 2000 - Unit Masonry: Installation of cast stone in conjunction with masonry.
- C. Section 07 9200 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.03 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- D. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2019.
- E. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2019, with Editorial Revision (2020).
- F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- G. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.
- H. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- I. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
- J. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).
- K. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2021.
- L. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
- M. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2025.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.
- C. Product Data: Test results of cast stone components made previously by the manufacturer.
 - 1. Include one copy of ASTM C1364 for Architect's use.
- D. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
- E. Mortar Color Selection Samples.

- F. Verification Samples: Pieces of actual cast stone components not less than 6 inches (___ mm) square, illustrating range of color and texture to be anticipated in components furnished for the project.
- G. Source Quality Control Test Reports: Test results prepared by an independent testing agency, indicating tested material characteristics as part

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility for Cast Stone Units: Provide cast stone units of a uniform texture and color, or a uniform blend within the ranges acceptable for these characteristics, from one source and by a single manufacturer.
- B. Manufacturer Qualifications: A current producer member of the Cast Stone Institute with a minimum of 15 years of experience in producing cast stone of the types required for project.
- C. Supervision: At least one skilled journeyman mason shall be present at all times during masonry work to personally supervise all work of this Section.
- D. Preinstallation Conference: Conduct conference at Project site.

1.06 MOCK-UPS

- A. Provide full size cast stone components for installation in mock-up of exterior wall.
 - 1. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.
- B. See Section 01 4000 - Quality Requirements for additional requirements.
 - 1. Approved mock-up will become standard for appearance and workmanship.
 - 2. Mock-up may remain as part of the completed work.
 - 3. Remove mock-up not incorporated into the work and dispose of debris.
- C. Source Quality Control: Test compressive strength and absorption of specimens selected at random from plant production.
 - 1. Test in accordance with ASTM C642.
 - 2. Select specimens at rate of 3 per 500 cubic feet (3 per 14 cubic m), with a minimum of 3 per production week.
 - 3. Submit reports of tests by independent testing agency, showing compliance with requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
- B. Number each piece individually to match shop drawings and schedule.
- C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
- D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt and maintain at least 3 inches clearance above grade. Place polyethylene or other plastic film between wood and other finished surfaces of units when stored for extended periods of time.
- E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
- F. Store mortar materials where contamination can be avoided.
- G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.
- H. Do not use salt or calcium-chloride to remove ice from masonry surfaces.
- I. Maintain materials and surrounding air temperature at minimum 52 degrees F prior to and 48 hours after completion of masonry work.

1.08 PROJECT CONDITIONS

- A. Coordination with Masonry: Coordinate production and delivery of cast stone units with unit masonry work.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of cast stone units to be left exposed. Immediately remove grout, mortar, and soil that come in contact with cast stone units.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
 - 2. Protect low level copings and projections from mortar droppings.
 - 3. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Architectural Cast Stone:
 - 1. Basis of Design: Advanced Architectural Stone: Cast Stone Panels - Profile per Drawings
 - 2. Arriscraft International as distributed by Cocreham Brick
 - 3. Or prior approved equal.

2.02 ARCHITECTURAL CAST STONE

- A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C1364.
 - 1. Compressive Strength: ASTM C 1194: 6,500 psi minimum for products at 28 days.
 - 2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C 1364. The CPWL shall be less than 5% after 300 cycles of freezing and thawing.
 - 3. Absorption: ASTM 1195: 6% maximum by the cold water method, or 10% maximum by the boiling method for products at 28 days.
 - 4. Air Content: ASTM C173 or C231, for wet cast product shall be 4-8% for units exposed to freeze-thaw environments. Air entrainment is not required for VCT products.
 - 5. Linear Shrinkage: ASTM C426: Shrinkage shall not exceed 0.065%.
 - 6. Surface Texture: Smooth
 - 7. Color: Basis of Design: Advanced Cast Stone, Inc., Natural Limestone.
 - 8. Remove cement film from exposed surfaces before packaging for shipment.
- B. Shapes: Provide shapes indicated on drawings.
 - 1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch (3 mm) or length divided by 360, whichever is greater, but not more than 1/4 inch (6 mm).
 - 2. Unless otherwise indicated on drawings, provide:
 - a. Wash or slope of 1:12 on exterior horizontal surfaces.
 - b. Drips on projecting components, wherever possible.
 - c. Raised fillets at back of sills and at ends to be built in.
- C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI CODE-318.
 - 1. Pieces More than 12 inches (305 mm) Wide: Provide full length two-way reinforcement of cross-sectional area not less than 0.25 percent of unit cross-sectional area.

2.03 MATERIALS

- A. Portland Cement: ASTM C150/C150M.
 - 1. For Units: Type I or II, white.
- B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.
- C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.
- D. Pigments: ASTM C 1364, ASTM C979, inorganic iron oxides; do not use carbon black.

- E. Admixtures: ASTM 1364, ASTM C494/C494M.
- F. Water: Potable.
- G. Fiber Reinforcement: ASTM C1116, fibrous nylon
- H. Retarding, Accelerating and High-Range Admixtures: to ASTM C494/C495M, Types A-G.
- I. Water Repellents and Other Chemical Admixtures: Previously established as suitable for use in concrete by proven field performance or through laboratory testing.
- J. Dark Mineral Admixtures: to ASTM C618.
- K. Reinforcing Bars: ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa), deformed bars, galvanized.
 - 1. Galvanized in accordance with ASTM A767/A767M, Class I.
- L. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.
- M. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
- N. Mortar: Portland cement-lime, ASTM C 270 Type N ; do not use masonry cement.
- O. Grout: maximum 6,500 psi at 28 days.
- P. Sealant: As specified in Section 07 9200.
- Q. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.
- R. Anchors: Stainless steel type.

2.04 FABRICATION

- A. Shapes: Fabricate cast stone masonry units to sizes and profiles indicated on Drawings.
 - 1. Provide suitable wash on exterior sills, copings, projecting courses, and components with exposed top surfaces.
 - 2. Drip on projecting components where possible.
- B. Do not use dark mineral admixtures in surfaces intended to be exposed to view.
- C. Reinforcement:
 - 1. Comply with ASTM C 1364
 - 2. As required to withstand handling and structural stresses.
 - 3. Minimum of 0.25 percent of cross sectional area of panels which exceed 24 inches in width.
 - 4. Minimum reinforcing cover: Twice the diameter of reinforcing bars.
 - 5. Units less than 24 inches in either transverse or longitudinal direction may be unreinforced in that direction if structural conditions allow.
 - 6. Reinforcement shall be noncorrosive where faces exposed to weather are covered with less than 1.5 inches of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.
 - 7. Panels, soffits, and similar stones greater than 24 inches in one direction shall be reinforced in that direction. Units less than 24 inches in both their length and width dimension shall be non-reinforced unless otherwise specified.
 - 8. Welded wire fabric reinforcing shall not be used in dry cast products.
- D. Curing:
 - 1. Cure units in a warm curing chamber approximately 100°F (37.8°C) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70°F (21.1°C) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350 degree-days (i.e. 7 days @ 50°F (10°C) or 5 days @ 70°F

- (21°C)) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.
2. Cure cast stone components in presence of carbon monoxide and carbon dioxide to promote carbination at surface to minimize efflorescence.
 3. Yard cure units for 350 degree days prior to shipping
- E. Finishing:
1. Remove blemishes from exposed surfaces before packaging for shipment.
- F. Manufacturing tolerances:
1. Manufacture cast stone components within tolerances in accordance with the Cast Stone Institute Standard Specification.
- G. Tolerance:
1. Cross Section Dimensions: Not deviating by more than plus or minus 1/8 inch from approved dimension.
 2. Length of Units: Not deviating by more than >/360 or plus or minus 1/8 inch, whichever is greater, with a maximum plus or minus 1/4 inch.
 3. Maximum Length of any Unit shall be a maximum 15 times the average thickness of the unit.
 4. Warp, Bow, or Twist of Units: maximum L/360 or plus or minus 1/8 inch, whichever is greater.
 5. Location of Dowel Holes, Anchor Slots, Flashing Grooves, False Joints: Maximum deviation as follows:
 - a. On Formed Sides of Unit: 1/8 inch
 - b. On Unformed Sides of Unit: 3/8 inch

2.05 FINISHES

- A. Exposed surfaces: Color to be Selected from Manufacturers full line. Surface shall be free of cracks, chips or other defects that would affect the strength or serviceability of the unit or become exposed once installed and visible when viewed from a distance of not less than 15 feet under diffused light.

2.06 SOURCE QUALITY CONTROL

- A. Test compressive strength and absorption from specimens selected at random from plant production to ASTM C1194 and ASTM C1195.
1. Test samples taken from every 500 cubic feet of product produced.
 2. Test new and existing mix designs for strength and absorption compliance prior to producing units.

2.07 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of units being cleaned.
1. For masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface-acting acids, chelating, and wetting agents.
 2. For dark-colored masonry not subject to metallic oxidation stains, use formulation consisting of a liquid blend of surface-acting acids and special inhibitors.
 3. For masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic and inorganic acids and special inhibitors.
 4. Approved Products/Manufacturers:
 - a. 202 New Masonry Detergents"; DIEDRICH TECHNOLOGIES, INC.
 - b. 200 Lime Solv"; DIEDRICH TECHNOLOGIES, INC.
 - c. 202V Vana-Stop"; DIEDRICH TECHNOLOGIES, INC.
 - d. Sure Klean No. 600 Detergent"; PROSOCO, INC.
 - e. Sure Klean No. 101 Lime Solvent"; PROSOCO, INC.

- f. Sure Klean Vana Trol"; PROSOCO, INC.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.
- B. Do not begin installation until unacceptable conditions have been corrected.
- C. Inspect materials for fit and finish prior to installation. Do not install unacceptable units.

3.02 INSTALLATION

- A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 2000.
- B. Mechanically anchor cast stone units indicated; set remainder in mortar.
- C. Setting:
 - 1. Drench cast stone components with clear, running water immediately before installation.
 - 2. Set units in a full bed of epoxie mortar unless otherwise indicated.
 - 3. Fill vertical joints with epoxie mortar.
 - 4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.03 TOLERANCES

- A. Joints: Make all joints 3/8 inch (9.5 mm), except as otherwise detailed.
 - 1. Rake mortar joints 3/4 inch (19 mm) for pointing.
 - 2. Remove excess mortar from face of stone before pointing joints.
 - 3. Point joints with mortar in layers 3/8 inch (9.5 mm) thick and tool to a slight concave profile.
 - 4. Leave the following joints open for sealant:
 - a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
 - b. Joints in projecting units.
 - c. Joints between rigidly anchored units, including soffits, panels, and column covers.
 - d. Joints below lugged sills and stair treads.
 - e. Joints below ledge and relieving angles.
 - f. Joints labeled "expansion joint".
 - 5. Mortar, Type N, ASTM C 270.
 - 6. Use a full bed of mortar at all bed joints.
- B. Sealant Joints: Install sealants as specified in Section 07 9200.
- C. Installation Tolerances:
 - 1. Variation from Plumb: Not more than 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m) or more.
 - 2. Variation from Level: Not more than 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch (9 mm) maximum.
 - 3. Variation in Joint Width: Not more than 1/8 inch in 36 inches (3 mm in 900 mm) or 1/4 of nominal joint width, whichever is less.
 - 4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch (1.5 mm) difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.04 REPAIR

- A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet (6 m).
 - 1. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.
 - 2. Repair methods and results subject to Architect 's approval.

3.05 FIELD QUALITY CONTROL

- A. Test one randomly selected sample from the field for each 500 cubic feet delivered to the job site. Verify compliance with the following:
 - 1. Three field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85 percent with no single specimen testing less than 75 percent of design strength as allowed by ACI 318.
 - 2. Three field cut cube specimens from each of these samples shall have an average maximum cold water absorption of 6 percent.
- B. Architect Inspection: Architect will inspect installed masonry and reject masonry that is chipped, cracked, or blemished (streaked, stained, or otherwise damaged, as described below).
 - 1. Masonry will be inspected to be free of chips, cracks or other blemishes on the finished face or front edges of the masonry units exceeding 3/8 inch or that can be seen from a distance of 10 feet.
 - 2. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 feet distance.
 - 3. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20 feet distance.
 - 4. Cracking and efflorescence will not be cause for rejection.
- C. Make Good rejected masonry as directed by Architect.

3.06 CLEANING

- A. Keep cast stone components clean as work progresses.
- B. Clean one-half of mock-up panel as directed below and leave for one week. If no harmful effects appear and after mortar has set and cured, clean masonry as follows:
 - 1. Protect windows, sills, doors, trim and other work from damage.
 - 2. Remove large particles with [stiff fiber brushes] [wood paddles] without damaging surface.
 - 3. Saturate masonry with clean water and flush off loose mortar and dirt.
 - 4. Dilute cleaning agent with clean water in controlled proportions.
 - 5. Apply solution to pre-soaked wall surface using soft-bristled brush.
 - 6. Thoroughly rinse cleaning solution and residue from wall surface.
- C. Use alternative cleaning solutions and methods for difficult to clean masonry only after consultation with cast stone masonry unit manufacturer.

3.07 PROTECTION

- A. Protect completed work from damage.
- B. Use protection materials and methods which will not stain or damage units.
- C. Remove protection materials upon Substantial Completion, or when risk of damage is no longer present.
- D. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Structural steel.
 - 2. Grout.
- B. Related Requirements:
 - 1. Division 09 painting Sections for surface preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 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 anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.
- C. The general contractor is responsible for coordinating the structural steel shop drawing submittal with all other submittals for elements which attach to structural steel or have an effect on structural steel design or detailing. This includes, but is not limited to, elevators, mechanical/electrical equipment, steel joists, pre-engineered metal stairs, railings, suspended partitions, sliding doors, suspended lights, glass storefront/curtainwall, roll-up doors, etc. Hold shop drawing production, ordering of material, fabrication, and other work associated with such elements as required until these other submittals are reviewed and approved. Provide separate submittals for these elements as required. Elevator steel shall be provided in a separate submittal. The general contractor shall coordinate between steel supplier and these other suppliers as required.

1.5 PREINSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at Project site (with video teleconferencing capabilities).

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include erection plans, sections, elevations, and details.
 - 2. Include details of cuts, connections, splices, camber, holes, and other pertinent data. Provide details of all non-standard connections not specifically indicated on the drawings for approval. Comply with all AISC minimum edge distance and spacing requirements.
 - 3. Include embedment Drawings.
 - 4. Include exact layout of all kicker braces which attach to open-web steel bar joists.
 - 5. Indicate size, material specification, surface preparation and coating for all members and components.
 - 6. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds when backing bars are to remain. Provide welding process and joint designation for all complete-joint-penetration and partial-joint-penetration welds.
 - 7. All required field welding shall be indicated on the erection drawings using erection details.
 - 8. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
 - 9. All column piece drawings shall indicate the grid location of the column.
 - 10. Reproductions made from contract drawings will not be accepted.
 - 11. For structural-steel connections indicated to comply with design loads, include structural analysis data by the qualified professional engineer responsible for their preparation.
 - 12. Shop drawings shall be computer generated using three-dimensional detailing software.
 - 13. The final three-dimensional model shall be transmitted electronically to the Engineer along with submittal of shop drawings. Model is provided for information only. All comments from review will be made on 2D shop drawings. The three-dimensional model shall be submitted in IFC (.ifc) format. A three-dimensional model shall also be sent for all pre-engineered metal stairs.
 - 14. Allow 21 days for review of structural steel shop drawings, excluding delivery time to and from the contractor.

15. On projects where submittals are processed electronically, provide Engineer with a minimum of one half-sized copy of shop drawings for office use only.
 16. For shop drawings that are marked "Make Corrections Noted", provide Architect/Engineer with an electronic record set of the shop drawings and three-dimensional model for informational purposes once all revisions are made.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code – Steel," for each welded joint qualified by testing, including the following:
1. Power Source.

1.7 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Qualification Data: For Installer and fabricator.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with top coats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 2. Direct-tension indicators.
 3. Tension-control, high-strength bolt-nut-washer assemblies.
 4. Shear stud connectors.
 5. Shop primers.
 6. Nonshrink grout.
- F. Source quality-control test reports.
- G. Survey of existing conditions.
- H. Field quality-control and special inspection reports.

1.8 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel."
- B. Comply with applicable provisions of the following specifications and documents:
 1. AISC 303.
 2. AISC 360.

3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repacking and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturer's written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M or ASTM A 572/A 572M, Grade 50.
- B. Channels, Angles-Shapes: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Corrosion-Resisting Structural Steel: ASTM A 588/A 588M, Grade 50.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C, structural tubing.
- F. Corrosion-Resisting, Cold-Formed Hollow Structural Sections: ASTM A 847, structural tubing.
- G. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 1. Weight Class: Standard, unless otherwise noted on drawings.
 2. Finish: Black, except where indicated to be galvanized.
- H. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirements S11.
- I. Steel Forgings: ASTM A 668/A 668M.
- J. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852 (also referred to as ASTM A 325 Tension-Control), Type 1, heavy hex head steel structural bolts with splined ends; ASTM A 563, Grade C (or Grade DH if indicated to be galvanized) heavy hex carbon-steel nuts; and ASTM F 436, Type 1 hardened carbon-steel washers.
 - 1. Finish: Plain, except where indicated to be galvanized.
- B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- C. Threaded and Nutted Anchor Rods (or Anchor Bolts): ASTM F 1554, Grade 55, weldable, straight.
 - 1. Nuts: ASTM A 563 heavy hex carbon steel.
 - 2. Plate Washers: ASTM A 36 carbon steel.
 - 3. Washers: ASTM F 436 hardened carbon steel.
 - 4. Finish: Plain, except where indicated to be galvanized.
- D. Threaded Rods: ASTM A 36
 - 1. Nuts: ASTM A 563 heavy hex carbon steel.
 - 2. Washers: ASTM A 36 carbon steel.
 - 3. Finish: Plain, except where indicated to be galvanized.
- E. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.
- F. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Primer chosen shall be compatible with any additional coatings required.
- C. For exposed structural steel, refer to Division 09 sections
- D. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 or ASTM A 780.
 - 1. Dry film shall have at least 94% metallic zinc by weight
 - 2. Coordinate with Division 09 Sections of field painting if exposed.

2.4 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.
 - 1. All grout shall have a minimum compressive strength of 5,000 psi at 28 days.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303 "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 - 1. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
 - 2. Mark and match-mark materials for field assembly.
 - 3. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces. Do not thermally cut bolt holes in the field or enlarge holes by burning.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."
- 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 written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes in the field or enlarge holes by burning.
 - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.
- H. All reinforcing bars to be welded to structural steel shall be ASTM A706, deformed, and fabricated in accordance with CRSI's "Manual of Standard Practice."

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Pretensioned.
 - 2. Use standard bolt holes. Slotted holes are not permitted unless indicated.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth for architecturally exposed structural steel members
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC 303 for mill material.
 - 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.
 - 4. All flare bevel groove welds shall be filled flush with top of round surface, unless noted otherwise.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches. This does not apply to columns.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials. This does not apply to intumescent coatings.
 - 5. Galvanized surfaces.
 - 6. Top flanges of composite steel beams that are specified to have headed shear studs attached.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 3, "Power Tool Cleaning."

- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).
- E. All structural steel shall be prepared in manner compatible with architectural requirements such as intumescent coatings, applied fire-proofing, high performance coatings, etc. Coordinate to verify compatibility between products chosen and/or methods of preparation. Identify any conflicts to Architect prior to fabrication of structural steel.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.
 - 1. Fill vent holes and grind smooth after galvanizing.
 - 2. Galvanize steel lintels and shelf angles attached to structural frame and located in exterior walls.
 - 3. Galvanize steel exposed to weather, U.N.O.
 - 4. Galvanize all other steel specifically indicated on Drawings.
 - 5. Galvanize all anchor bolt assemblies for steel members outside building enclosure.
 - 6. Galvanized anchors and nuts shall be purchased from same supplier and shall be shipped preassembled.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

- D. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1 and the following inspection procedures, 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. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.
- F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after 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.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

- B. Baseplates 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. Snug-tighten anchor rods 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 before packing with grout.
 3. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
 4. All grout shall be placed under steel column base plates and achieve 70% of its required 28-day strength prior to placement of concrete for elevated floors which are supported by the steel columns.
 5. Grout shall be placed with fluid consistency if column blockouts are used at ground floor slab.
- C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC 303, "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 with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is 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.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Do not cut holes in structural steel framing unless indicated on structural drawings.
- J. Headed Stud Anchors: Prepare steel surfaces as recommended by manufacturer of headed stud anchors. Use automatic end welding of headed stud anchors according to AWS D1.1 and manufacturer's written instructions. Welding shall develop full capacity of headed stud anchor.
- K. All structural steel diagonal brace members shall be set and attached to the steel frame prior to placement of concrete for elevated floors.

- L. Remove all factory piece markings (especially if welded on to the member) by grinding smooth on all elements to be exposed prior to field painting.
- M. All loose lintels supporting masonry or stone veneer shall be set such that the veneer has a minimum bearing width of 2-1/2 inches. Coordinate lintel placement with Architect at head of door/windows with veneer above.
- N. For members which provide shelf support of masonry or stone veneer, verify accuracy of alignment and elevation prior to permanently fastening. Contact Architect/Engineer if field adjustments to connections of members are required to accommodate tolerances.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Pretensioned
 - 2. Provide and install a tension-control, high-strength bolt-nut-washer assembly for all bolts on field bolted connections.
 - 3. Use standard bolt holes. Slotted holes are not permitted unless indicated.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 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 for architecturally exposed structural steel connections.
 - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC 303, "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 - 4. 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.
 - 5. All flare bevel groove welds shall be filled flush with top of round surface, unless noted otherwise.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.

2. Verify weld materials and inspect welds.
 3. Verify connection materials and inspect high-strength bolted connections.
 4. Verify all other applicable items as required per Chapter N of AISC 360.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspection.
- C. All inspection and tests shall be performed in accordance with Chapter N of AISC 360.
- D. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. Welded Connections: Visually inspect field welds according to AWS D1.1. See structural drawings for additional requirements on weld inspection.
1. In addition to visual inspection, test and inspect field welds according to AWS D1.1 and the following inspection procedures, at testing agency's option or as specified on structural drawings:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. 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.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- F. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.
- G. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
1. All corrections shall be submitted to the Project Architect and Engineer for review and approval. Correction work shall not proceed until approval has been provided.
 2. Significant deficiencies in construction which require substantial engineering to resolve may require the contractor to secure the services of a professional engineer at no additional cost to the owner. The Project Architect and/or Engineer of Record will determine if a contractor hired engineer is required depending on the severity of the deficiency and the extent of work involved.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780 and manufacturer's written instructions.
- B. Touchup Priming: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - 2. Remove all factory piece markings (especially if welded on to the member) by grinding smooth on all elements to be exposed prior to field touchup priming operations. Touchup prime all repaired spots that required field grinding and cleanup which damaged the shop priming.
- C. Touchup Painting: Cleaning and touchup painting for exposed steel are specified in Division 09 painting Sections.

3.7 MISCELLANEOUS STEEL

- A. Unless otherwise indicated on the structural drawings, provide angles, tubes, plates, channels, and other steel members shown on the architectural drawings and connect with 1/4" fillet weld at all material interfaces. Unless otherwise indicated, the following assumptions shall be made regarding spacing and member size shown on the architectural drawings in order to establish an all-inclusive structural steel bid price. Plates-5/16", Cont. Bent Plate- 5/16", Angle-L5x5x3/8, Channel Horizontally Oriented- C12x30, Channel Vertically Oriented-C6x8.2, Wide Flange-W18x35, Tube-HSS 6x6x3/8. Members/pieces shown in section shall be assumed continuous unless otherwise noted. Spacing intervals of stiffeners, hangers, kickers, 30"OC. Columns W6x6X3/8". It is the contractor's responsibility to coordinate and verify all structural steel shapes indicated in architectural drawings, prior to bid.

END OF SECTION 05 12 00

SECTION 05 21 00
STEEL JOIST 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. K-series steel joists.
 - 2. Joist accessories.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for associated steel framing work.

1.3 DEFINITIONS

- A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product.
- B. Shop Drawings: Reproductions made from contract drawings will not be accepted. Submit one (1) electronic print. Review of shop drawings by the Architect/Engineer will be for general compliance with contract documents.
 - 1. Include layout, designation, number, type, location, and spacing of joists.
 - 2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
 - 3. Indicate locations and details of bearing plates to be embedded in other construction.
 - 4. Indicate that joists are designed for all special loading as given on the structural drawings.
 - 5. All special loading shall be clearly identified and located on joist placement plan in shop drawings.

6. Includes details for discontinuous bridging placement where required.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Welding certificates.
- C. Manufacturer certificates.
- D. Mill Certificates: For each type of bolt.
- E. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.
- F. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."
 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - 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 to be built into cast-in-place concrete and/or masonry construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
 1. Use ASD; data are given at service-load level, unless otherwise indicated.
 2. Design special joists to withstand design loads with live-load deflections no greater than the following:
 - a. Roof Joists: Vertical deflection of 1/360 of the span.

- b. Deflection limits above apply to all spans of joist, including cantilevered extensions.
- 3. All special loads indicated on Drawings shall be in addition to allowable loads required by SJI for given span of joist.
- 4. All joist top chords shall pass bend-check for 300 pound concentrated live load.

2.2 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specification 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.
 - 1. Joist Type: K-series steel joists and/or KCS-type K-series steel joists.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Provide holes in chord members for connecting and securing other construction to joists. Deduct area of holes from the area of chord when calculating strength of member.
- 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. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- F. Unless noted otherwise, all cantilevered joist extensions shall at a minimum have a capacity equal to the capacity of the main joist span designation.
- G. Camber joists according to SJI's "Specifications". Reduce camber at adjacent joists with varying lengths or at adjacent non-cambered structural steel beams or walls as required to prevent deck installation problems.
- H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.3 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
- B. Primer: Provide shop primer that complies with Division 09 Painting Sections applicable to location and requirements of joist framing.

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. Furnish additional erection bridging if required for stability.

- B. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint.
- C. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated. Provide ceiling extensions at all locations required to accommodate architectural detailing.
 - 1. Finish: Same as joist material.
- D. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
- E. Welding Electrodes: Comply with AWS standards.
- F. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.
- G. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
- B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
- C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing 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. 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 instructions, 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.
 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.
- C. Field weld joists to supporting steel bearing plates and framework as per SJI minimum standards or as otherwise indicated on the drawings if the drawings indicate welds which exceed SJI welding standards. 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. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- E. 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.
- F. Install and connect L1-1/2x1-1/2x3/16 stiffening angles on each side of joist at all concentrated loads applied to joist in accordance with typical detail on structural plans. Weld each end of stiffening angles all around.
- G. Do not make attachments to joist which induce twisting in the joist. All attachments shall be concentric to the joist member.
- H. Where bottom chord bridging conflicts with architectural, mechanical, electrical, plumbing, or other components with fixed locations, omit bridging as required and provide diagonal bridging in adjacent bays as approved by joist supplier and in accordance with joist supplier's requirements. Coordinate bridging locations with other fixed components prior to bridging installation. Adjust and/or provide additional bridging as required to comply with joist supplier's requirements.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner shall engage a qualified independent testing agency to perform tests and inspections and prepare test and inspection reports. Tests and inspection shall be in accordance with Chapter 17 of the International Building Code.
- B. Visually inspect field welds according to AWS D1.1/D1.1M.
1. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165/E 165M.
 - b. Magnetic Particle Inspection: ASTM E 709.

- c. Ultrasonic Testing: ASTM E 164.
 - d. Radiographic Testing: ASTM E 94.
- C. Visually inspect bolted connections.
- D. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."
- E. Prepare test and inspection reports.
- F. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- G. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
 - 1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2 or power-tool cleaning according to SSPC-SP 3.
 - 2. Apply a compatible primer of same type as primer used on adjacent surfaces.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion

END OF SECTION 05 21 00

**SECTION 05 31 00
STEEL DECKING**

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. Roof deck.
- B. Related Requirements:
 - 1. Division 03 Section "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
 - 2. Division 05 Section "Structural Steel" for shop- and field-welded shear connectors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Reproductions made from contract drawings will not be accepted. Submit one (1) electronic print. Review of shop drawings by the Architect/Engineer will be for general compliance with contract documents.
 - 1. Include plans showing layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
- D. Evaluation Reports: For steel deck.
- E. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Canam Steel Corporation.
 - 2. Epic Metals Corporation.
 - 3. New Millennium Building Systems, LLC.
 - 4. Nucor Corp.; Vulcraft Group. (design basis on structural plans)
 - 5. Valley Joist.
 - 6. DACS, Inc.
 - 7. Cordeck.
 - 8. Consolidated Systems, Inc.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50 (minimum yield stress in ksi), G60 zinc coating. At all exposed conditions, galvanized deck shall be cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer. Verify compatibility with top coat specified by Architect.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
6. Span Condition: Triple span or more unless not permitted by geometry.
7. Side Laps: Overlapped.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Fasteners indicated on plans as "Tek Screws" shall be self-drilling tapping screws complying with the material, process, and performance requirements of ASTM C1513. Tek screws shall be corrosion resistant and meet the minimum requirements of ASTM F1941. Provide larger screws if required for attachment to structural steel. Provide screws penetrating joined members by not less than three exposed screw threads.
- E. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- F. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- G. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- H. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- I. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

- J. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- K. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- L. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- M. Galvanizing Repair Paint: ASTM A 780.
- N. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

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.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. 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.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work. See structural drawings for 12 gage reinforcement plate required at small openings in the deck.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Deck fasteners shall be in accordance with structural contract drawings.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members as indicated on the plans.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels as indicated on the plans.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum or butted at Contractor's option (do not butt at open web steel joist).
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 4 inches apart with at least one fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. mechanically fasten 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 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests and inspections shall be performed in accordance with SDI-QA/QC "Standard for Quality Control and Quality Assurance for Installation of Steel Deck."
- C. Field welds will be subject to inspection.
- D. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- E. Remove and replace work that does not comply with specified requirements.
- F. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.
- G. Prior to placement of roofing material over metal roof deck, the Contractor shall notify Testing Agency to perform inspection of roof deck fastening to supporting elements. Roofing material shall not be placed until inspection results are reviewed by Architect and all corrective work is complete.

3.5 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. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 - 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 09 Section.
- C. 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior non load-bearing wall framing (Delegated design. See Performance Requirements).
 - 2. Exterior framing (Delegated design).
- B. Related Sections include the following:
 - 1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Division 9 Section "Gypsum Board Assemblies" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads shown in plans and/or code requirements and for resisting wind pressures determined from the wind speeds, exposure and risk category provided on plans.
 - 1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non Load-Bearing Wall Framing: Horizontal deflection of 1/600 of the wall height for walls supporting brick/masonry veneer. Horizontal deflection of 1/360 of wall height for all other walls. Ultimate wind loads may be multiplied by 0.42 as allowed by IBC for purposes of wall deflection limits.
 - b. The above deflection limits apply at all spans of the framing member, including cantilever spans and overhangs.
 - 2. 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.

3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 3/4 inch.
 4. Design cold-formed framing systems to withstand any design loads and forces acting onto the cold-formed framing systems from any storefront/glass assemblies. Proper consideration of point loads from mullions shall be indicated in the design calculations.
 5. Design cold-formed framing systems to accommodate connections of any storefront/glass assemblies.
 6. All framing conditions which preclude the complete usage of cold-formed metal framing as indicated on the construction documents shall be identified prior to bidding or be resolved after bidding at no additional cost to the owner. Provide fixed connections to the structure where required for stability at cantilever conditions. Connections to structure shall be designed and provided by cold-formed metal framing supplier. Only provide fixed connections to structure when required for stability. Do not add kicker braces to reduce the span length of exterior wall studs. Do not attach to bottom flange of steel beams unless indicated on structural drawings.
 7. Design all exterior soffit ceilings to resist positive and negative wind pressure in accordance with ASCE 7. Design soffit framing for dead weight of soffit and for a vertical construction live load of 10 psf minimum and a simultaneous 300 pound point load where erector can stand and otherwise load such framing.
 8. Design interior wall framing for a net horizontal differential pressure of 5 psf perpendicular to the wall surface (in either direction) due to differential interior air pressure between rooms and incidental loading.
 9. Thickness of cold-formed metal framing shall be minimum required for anchorage at all louvers, doors, windows, and other wall openings. Coordinate with applicable supplier for minimum thickness of material for anchorage at framed wall openings.
- 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 non-load-bearing 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 metal framing product and accessory indicated.
- 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. Layout for metal stud wall framing shall include building elevations and/or wall plans indicating applicable wall sections in shop drawings. Provide wall sections for all unique exterior wall framing conditions around perimeter of building, including applicable locations where sections have not been provided in contract drawings. Contact Architect/Engineer prior to submittal of Shop Drawings if any additional information is required. For exterior canopies supported by cold-formed metal framing, the detailing of canopy connections to the cold-formed metal framing shall be clearly indicated on the shop drawings (general contractor shall coordinate loading and connection compatibility between canopy supplier and cold-formed metal stud supplier). For ladders supported by cold-formed metal framing, the detailing of ladder connections to the cold-formed metal framing shall be clearly indicated on the shop drawings (general contractor shall coordinate loading and connection compatibility between ladder supplier and cold-formed metal stud supplier).
 - 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.
 - 2. Submit shop drawings, sealed and signed by a qualified Louisiana Registered Civil Engineer.
 - a. Shop drawings shall be computer generated using two-dimensional drafting software (minimum).
 - b. Shop drawings (and all other information necessary for field construction) shall be on completely separate sheets from structural analysis data (calculations).
 - 3. Allow 21 days for review of cold-formed metal framing shop drawings, excluding delivery time to and from the contractor.
 - 4. For shop drawings that are marked "Mark Corrections Noted", provide Architect/Engineer with an electronic record set of the shop drawings for informational purposes once all revisions are made.
 - 5. Do not submit shop drawings prior to review and approval of storefront/glass assembly submittals and pre-engineering metal building submittals.
- C. Welding certificates (if any welding is required).

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 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 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, or in-house testing with calibrated test equipment 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/D1.1M, "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 - Truss Design."
 - 2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
- I. The general contractor is responsible for coordinating with the cold-formed metal framing Design Engineer to ensure the metal framing is installed in accordance with the approved shop drawings. The Architect/Engineer is not responsible for verifying proper installation of cold-formed metal framing.
- J. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, the Steel Framing Alliance, or the Steel Stud Manufacturers Association.

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 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing, not including pre-engineered roof trusses, by one of the following:
 - 1. AllSteel & Gypsum Products, Inc.
 - 2. California Expanded Metal Products Company.
 - 3. ClarkDietrich Building Systems
 - 4. Consolidated Fabricators Corp.; Building Products Division.
 - 5. Custom Stud, Inc.
 - 6. MarinoWare; a division of Ware Industries.
 - 7. SCAFCO Corporation.
 - 8. Steel Construction Systems.
 - 9. Steeler, Inc.
 - 10. United Metal Products, Inc.
 - 11. Super Stud Building Products, Inc.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90, A60, AZ50, or GF30.
- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.

2. Coating: G90.
- C. Screws: All screws used in the manufacture of steel roof trusses shall be exterior rated zinc coated self-drilling screws.

2.3 EXTERIOR NON-LOAD-BEARING 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 design but in no case less than 0.0428 inch.
 2. Minimum Flange Width: 1-5/8 inches.
 3. Section Properties: As required by design. See drawings for required depth of wall.
- 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: As required by design but in no case less than 0.0428.
 2. Minimum Flange Width: 1-1/4 inches.
 3. Section Properties: As required by design. See drawings for required depth of wall.
- C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 1. Minimum Base-Metal Thickness: As required by design but in no case less than 0.0428 inch.
 2. Flange Width: 1 inch plus the design gap for 1-story structures.
 3. Section Properties: As required by design. See drawings for required depth of wall.
- D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:

- a. Minimum Base-Metal Thickness: As required by design but in no case less than 0.0428 inch.
 - b. Minimum Flange Width: 1 inch plus twice the design gap.
 - c. Section Properties: As required by design. See drawings for required depth of wall.
- 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: As required by design but in no case less than 0.0428 inch.
 - b. Minimum Flange Width: width equal to the sum of outer deflection track flange width plus 1 inch.
 - c. Section Properties: As required by design. See drawings for required depth of wall.
- E. 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.

2.4 EXTERIOR FRAMING

- A. Steel Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by design but in no case less than 0.0329 inch.
 - 2. Minimum Flange Width: 1-5/8 inches.
 - 3. Minimum section: as required structurally or as specified on plans. See drawings for maximum allowed depth of element.

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, 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. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel headless, hooked bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. 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.
- D. 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.
- E. 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.
- F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.
- B. Cement Grout (if required): Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

- C. Nonmetallic, Nonshrink Grout (if required): Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims (if required): Load bearing, high-density multimonomer plastic, nonleaching.
- E. Sealer Gaskets (if required): Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 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. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

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 7 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.
- K. Exterior Soffit Framing: Provide horizontal and vertical members as required for support of all exterior soffit ceilings. Vertical members shall be provided at all structural steel beam and open web steel joist locations to uniformly distribute weight and loading of soffit ceiling to structure above. Vertical members shall not attach directly to non-composite concrete metal floor decks and metal roof decks. All attachments to open web steel joists shall be made at each panel point location. All kickers shall only be provided between metal stud framing member where required for stability and without interfering with other work or requirements indicated by the drawings. Kicker brace configurations shall not induce torsion or twisting into floor beams or joists and attachments shall be made for direct transfer of horizontal to floor or roof deck, where required for stability.

3.4 EXTERIOR NON-LOAD-BEARING WALL 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. Maximum Stud Spacing: 16 inches, or as indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. At Contractor's option, single or double deflection tracks may be used.
 - 2. Install single deflection track and attach to building structure.
 - 3. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 4. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 72 inches apart. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- 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. Provide miscellaneous framing and connections as required for support of all masonry veneer, cast stone bands, and other wall covering elements.

3.5 FIELD QUALITY CONTROL

- A. Testing: Owner 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 5000
METAL FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel and aluminum items including:
 - 1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 2. Miscellaneous steel trim.
- B. Downspout boots.
- C. Products includes in this Section:
 - 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.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.
- C. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.
- D. Section 05 3100 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.
- E. Section 09 9000 - Painting and Coating: Paint finish.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- F. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019a.
- G. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.
- H. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- I. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- J. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- K. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric); 2012.
- L. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- M. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- N. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

- O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- P. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
- Q. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- R. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

1.06 EXTRA MATERIALS

- A. Furnish touchup kit for each type and color of paint finish provided.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Plates: ASTM A283/A283M.
- C. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.
- D. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.
- E. Bolts, Nuts, and Washers: Stainless steel.

2.03 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

- A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
 - 1. Painted Finish: Safety Yellow unless otherwise indicated.
- B. Lintels: As detailed; prime paint finish.

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2.05 DOWNSPOUT BOOTS

- A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots and on-body cleanout and cover with neoprene gaskets.
 - 1. Configuration: As indicated in drawings.
 - 2. Material: Cast aluminum
 - 3. Finish: Manufacturer's standard factory applied powder coat finish.
 - 4. Color: To be selected by Architect from manufacturer's full range.
 - 5. Accessories: Manufacturer's standard stainless steel fasteners, stainless steel building wall anchors, and rubber coupling.
 - 6. Manufacturers:
 - a. Kinetic Architectural Products: www.kineticarch.com.
 - b. Barry Pattern & Foundry: www.barrycraft.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.06 FINISHES - STEEL

- A. Prime paint steel items.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

2.07 FINISHES - ALUMINUM

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
- B. Class II Natural Anodized Finish: AAMA 611 AA-M12C22A31 Clear anodic coating not less than 0.4 mils (0.01 mm) thick.
- C. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; color as indicated.

2.08 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.
- 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 will be 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.
 - 1. 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 embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.09 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

2.10 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 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. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with primer specified in Section 09 9000, or Section 09 9600 where indicated.

2.11 METAL DOWNSPOUT BOOTS

- A. Provide downspout boots made from cast aluminum in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.

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. Prime loose steel lintels located in exterior walls with primer specified in Section 09 9000 or Section 09 9600, as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 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 will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.04 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Perform field welding in accordance with AWS D1.1/D1.1M.
- D. Obtain approval prior to site cutting or making adjustments not scheduled.
- E. After erection, prime welds, abrasions and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.05 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

**SECTION 06 1000
ROUGH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheathing.
- B. Roofing nailers.
- C. Roofing cant strips.
- D. Preservative treated wood materials.
- E. Fire retardant treated wood materials.
- F. Communications and electrical room mounting boards.
- G. Concealed wood blocking, nailers, and supports.
- H. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

- A. Section : Setting anchors in concrete.
- B. Section 07 2100 - Thermal Insulation: Insulative board sheathing, batt insulation
- C. Section 07 2726 - Fluid Applied Non Permeable Air Barrier - weather barrier.
- D. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.
- E. Section 07 7200 - Roof Accessories: Coping

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- E. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.
- F. PS 1 - Structural Plywood; 2023.
- G. PS 20 - American Softwood Lumber Standard; 2020.
- H. SPIB (GR) - Standard Grading Rules; 2021.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures.
- B. Product Data: Provide technical data on wood preservative materials and application instructions, fasteners.
- C. Fastener type and spacing.
- D. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Southern Pine, unless otherwise indicated.
 - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.
- C. Provide dressed lumber, S4S, unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

- A. Roof Sheathing[<>]: Plywood, PS 1, Grade C-C, Exterior Exposure.
 - 1. Thickness: 5/8"
 - 2. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 500 days.
 - 3. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches and 24 inches on center, respectively.
- B. Wall Sheathing: Plywood, PS 1, Grade C-C, Exterior Exposure.
 - 1. On roof side of parapets.
 - 2. Thickness: 5/8".
- C. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, 5/8 inch Type X fire resistant (16 mm Type X fire resistant).
 - 1. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 2. Edges: Square.
 - 3. Products:
 - a. CertainTeed Corporation; GlasRoc Brand: www.certainteed.com/#sle.
 - b. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- D. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- E. Other Applications:
 - 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 - 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
 - 3. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

- A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - a. Where rough carpentry is in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
3. Nails, Brads, and Staples: ASTM F 1667.
4. Power-Driven Fasteners: NES NER-272.
5. Wood Screws: ASME B18.6.1.
6. Lag Bolts: ASME B18.2.1.
7. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
8. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - a. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - b. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.
9. Metal Framing Anchors
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Alpine Engineered Products, Inc.
 - 2) Cleveland Steel Specialty Co.
 - 3) Harlen Metal Products, Inc.
 - 4) KC Metals Products, Inc.
 - 5) Simpson Strong-Tie Co., Inc.
 - 6) Southeastern Metals Manufacturing Co., Inc.
 - 7) USP Structural Connectors.
 - b. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
 - c. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWWPA U1 - Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 2. Preservative Chemicals: Acceptable to authorities having jurisdiction.
 3. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Fire Retardant Treatment:
 1. Products:
 - a. Arch Wood Protection, Inc: www.wolmanizedwood.com.
 - b. Hoover Treated Wood Products, Inc: www.frtw.com.

- c. Osmose, Inc: www.osmose.com.
- 2. Interior Type A: AWP A U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated .
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Application: Treat items indicated on Drawings, and the following:
 - 1. Retain subparagraph below if Project includes wood adjacent to roofing or waterproofing.
 - 2. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 3. Retain applicable items below. Insert other items that require treatment but are not likely to be indicated on Drawings.
 - 4. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 5. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 6. Wood floor plates that are installed over concrete slabs-on-grade.

PART 3 EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, masonry and concrete construction install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches (100 mm) and seal.
- B. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Provide the following specific nonstructural framing and blocking:

1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.
10. Other items as required.

3.04 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.05 INSTALLATION OF CONSTRUCTION PANELS

- A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
 1. At long edges provide solid edge blocking where joints occur between roof framing members.
 2. Attach to metal decking as recommended by manufacturer for high slope installation.
- B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws.
- C. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 3. Install adjacent boards without gaps.

3.06 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.07 CLEANING

- A. Waste Disposal: See Section .
 1. Comply with applicable regulations.
 2. Do not burn scrap on project site.
 3. Do not burn scraps that have been pressure treated.
 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

SECTION 06 2000 FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items.
 - 1. Wood Moldings

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.
- C. Section 09 9000 - Painting and Coating: Painting and finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

- A. NHLA G-101 - Rules for the Measurement and Inspection of Hardwood and Cypress; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data:
 - 1. Provide instructions for attachment hardware and finish hardware.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
 - 2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- D. Samples: Submit two samples of wood trim 24 inch (300 mm) long.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Interior Woodwork Items:
 - 1. Moldings, Bases (**WB-1**)
 - a. Species: Poplar
 - b. Finish: Painted
 - c. Height: 10" unless otherwise indicated in Drawings.
 - d. Profile: As indicated in Drawings.

2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.

2.03 LUMBER MATERIALS

- A. Medium Hardness Lumber: Poplar species, Plain Sawn sawn, maximum moisture content of 13 percent for interior wood.
 - 1. AWI: Grade 1
 - 2. Grading: In accordance with rules certified by ALSC; www.alsc.org.
- B. Hardwood Lumber: Maple species, Plain Sawn sawn, maximum moisture content of 11 percent for interior wood, and 15% exterior wood; with vertical grain, of quality suitable for transparent finish.
 - 1. AWI: Grade I
 - 2. Grading: In accordance with NHLA G-101 Grading Rules; www.nhla.com.

2.04 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Fasteners: Of size and type to suit application; Galvanized finish in concealed locations and Galvanized finish in exposed locations, set for application of wood filler.

2.05 ACCESSORIES

- A. Lumber for Shimming and Blocking: Softwood lumber of any species. To meet 06 1000 Rough Carpentry specifications.
- B. Wood Filler: Solvent base, tinted to match surface finish color.
- C. Shop assemble work for delivery to site, permitting passage through building openings.

2.06 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. Stain: As selected by Architect.
 - b. Sheen: Satin.
 - 2. Opaque:
 - a. Color: As selected by Architect.
 - b. Sheen: Semigloss.
- D. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing, blocking and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.
- C. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

3.02 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Countertops.
- C. Hardware.
- D. Closet and Utility Shelving

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
 - 2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
 - 3. Verify all equipment, plumbing, fixtures, appliances, etc. to be installed within millwork and include accurate dimensions in shop drawings plans and sections.
- C. Product Data: Provide data for hardware accessories.
- D. Product Data: Include cut sheets of all equipment, plumbing, fixtures, appliances, etc. to be installed within millwork for informational, coordination, and reference purposes.
- E. Samples: Submit actual sample items of proposed pulls, plastic laminate, hinges, plastic laminate, shelf standards, plastic laminate, locksets, plastic laminate, and plastic laminate, demonstrating hardware design, quality, and finish.
- F. Samples for verification of the following:
 - 1. Laminate-clad panels, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
 - 2. Edge banding 10 inches for each type, color, pattern and surface finish.
- G. Product certificates signed by woodwork fabricator certifying that products comply with specified requirements.
- H. 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.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience. With sufficient production capacity to produce required units without delaying the Work.
 - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Single-Source Responsibility for Fabrication and Installation: Engage a pre-qualified woodworking firm to assume undivided responsibility for fabricating, finishing, and installing interior architectural woodwork specified in this Section.
- C. Quality Certification: Provide AWI Quality Certification Program inspection report and quality certification of completed work.
 - 1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 2. Provide designated labels on shop drawings as required by certification program.
 - 3. Provide designated labels on installed products as required by certification program.
 - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.07 MOCK-UP

- A. Mockups: Prior to fabricating or installing paneling, casework, and laminate casework, construct mockups of each separate finish to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups of the size requested, using materials indicated for final unit of work, and complying with the following requirements.
 - 1. Locate mockups on site in the location indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect one week in advance of the date and time when fabrication of mockup will begin.
 - 3. Notify Architect one week in advance of the date and time when mockups will be installed.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Obtain Architect's acceptance of mockups before start of final unit of Work.
 - 6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - a. Accepted mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.
- B. Mock-up may remain as part of the Work, once approved by Architect.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.
- B. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Field Conditions" below.
- C. Protect units from moisture damage.

1.09 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.
- B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

- C. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.
 - 2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Filler panels are not to exceed 1 ½" each side of a run.

1.10 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.
 - 1. AWI Type of Cabinet Construction: Flush overlay. Unless otherwise indicated in drawings. Use of plywood required where indicated on drawings.
 - 2. Materials for Semiexposed Surfaces: Provide surface materials indicated below:
 - a. Surfaces Other than Drawer Bodies: High-pressure decorative laminate, Grade GP-28.
 - b. Drawer Sides and Backs: High-pressure decorative laminate (melamine) on 1/2" MDF core per AWI standards.
 - 3. Colors, Patterns, and Finishes: As indicated on finish schedule.
 - 4. Wood Trim: Comply with the following:
 - a. Opaque: Poplar.
 - 5. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers except where located directly under tops.

2.02 WOOD-BASED COMPONENTS

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," for lumber and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
 - 1. SPIB - Southern Pine Inspection Bureau.
 - 2. WWPA - Western Wood Products Association.
- C. Softwood Plywood: Comply with U.S. Commercial Standards, CS45.
- D. Hardwood Plywood: Comply with U.S. Commercial Standards, CS45.
- E. Hardboard (including soft hardwoods) and Lumber Core Hardwood Veneer: All finish exposed hardwood to comply with grading of American Woodworking Institute.
- F. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.

2.03 LAMINATE MATERIALS

- A. Manufacturers:

1. Panolam Industries International, Inc\Nevamar: www.nevamar.com.
 2. Basis of Design (PL-1): Panolam: www.panolam.com
 3. Basis of Design (PL-2): Wilsonart: www.wilsonart.com.
 4. Laminart
 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications, unless indicated other wise on finish schedule.
- C. Provide specific types as indicated.
1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, through color, colors as indicated, finish as indicated.
 2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, through color, _____ color, finish as indicated.
 3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch (1.0 mm) nominal thickness, through color, colors as indicated, finish as indicated.
 4. Edges: GHGS, 0.048 inch (1.22 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
- D. Adhesive for Bonding Plastic Laminate: Urea-formaldehyde.

2.04 COUNTERTOPS

- A. Countertops: See Section 12 3600.
- B. Plastic Laminate Countertops: Medium density fiberboard substrate covered with HPDL, conventionally fabricated and self-edge banded.

2.05 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
1. Color and Pattern: To match adjacent laminate, unless indicated otherwise.
 2. Use at all exposed edges.
- C. Fasteners: Size and type to suit application.
- D. Concealed Joint Fasteners: Threaded steel.
- E. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface. Size as selected by Architect.

2.06 HARDWARE

- A. Provide hardware and accessory materials associated with architectural cabinets.
1. Approved cabinet hardware manufacturers as follows or as specified in drawings:
 - a. Hafele.
 - b. Grant.
 - c. Knape & Vogt Manufacturing Company
 - d. Lescoa.
 - e. Stanley.
 - f. Blum.
 2. Cabinet hardware to be supplied and installed by millworks shall include all drawer slides, and wshelf and countertop supports.
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by reference to BHMA numbers or referenced to this standard.
- C. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA code number indicated.
1. Bronze: BHMA 613 or Satin Stainless Steel, Stainless-Steel Base: BHMA 630. (Or as specified in drawings).

- D. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of BHMA A156.9.
- E. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.
- F. Heavy Duty Shelf Brackets:
 - 1. Products:
 - a. Knappe and Vogt #182 Series, Heavy Duty Shelf Bracket. Color: Titanium.
 - b. Or Prior Approved Equal.
- G. Fixed Specialty Brackets:
 - 1. Manufacturers:
 - a. Basis of Design: Doug Mockett Worksurface Support, SWS 2 Metallic Silver.
- H. Fixed Concealed Countertop Support Brackets:
 - 1. Material: Steel
 - 2. Finish: Manufacturer's standard, factory-applied powder coat.
 - 3. Color: Selected by Architect from manufacturer's standard range.
 - 4. Manufacturers: Richelieu: www.richelieu.com
 - a. For spans greater than 30" and 24" deep counter: Richelieu 6240141890
 - b. For spans greater than 30" and 30" deep counter: Richelieu 6240142490
- I. Drawer and Door Pulls: Cabinet Drawer & Door Typical Pulls Doug Mockett DP269B -7 7/8" Drop Edge ADA Drawer Pull. Installed recessed flush into door & drawers. Finish to be Satin Aluminum (94). Provide drawer pulls at all false fronts.
- J. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
 - 1. Locations: As Noted in Drawings
- K. Drawer Slides:
 - 1. Type: Full extension.
 - 2. Static Load Capacity: Commercial grade.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - 5. Features: Provide self closing/stay closed type.
 - 6. Manufacturers:
 - a. Accuride International, Inc: www accuride.com.
 - b. Grass America Inc: www.grassusa.com.
 - c. Knappe & Vogt Manufacturing Company: www.knappeandvogt.com.
- L. Hinges: European style concealed self-closing type, steel with polished finish.
 - 1. Manufacturers:
 - a. Grass America Inc: www.grassusa.com.
 - b. Hardware Resources: www.hardwareresources.com.
 - c. Julius Blum, Inc: www.blum.com.

2.07 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly

bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)

1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.03 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) for plumb and level (including tops).
- C. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- D. Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.
 1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
- E. Use fixture attachments in concealed locations for wall mounted components.
- F. Use concealed joint fasteners to align and secure adjoining cabinet units.
- G. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.
- H. Secure cabinets to floor using appropriate angles and anchorages.
- I. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.04 ADJUSTING

- A. Repair damaged and defective woodwork where possible to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.
- D. Adjust moving or operating parts to function smoothly and correctly.

3.05 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion

3.06 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

3.07 CABINET HARDWARE AND ACCESSORY SCHEDULE

- A. BHMA are used below to designate hardware requirements, except as otherwise indicated.
 - 1. Concealed (European Type) Hinges: B01602 (100° operation, unless otherwise noted).
 - 2. Pulls: 4" wire pull.
 - 3. Magnetic Catches: B03141.
 - 4. Shelf Rests: B04081.
 - 5. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, complying with BHMA A156.9, Grade 1 and rated for the following loads:
 - a. Box Drawer Slides: 100 lbf (440 N) at full extension.
 - b. File Drawer Slides: 200 lbf (890 N) at full extension.
 - c. Pencil Drawer Slides: 45 lbf (200 N) at full extension.
 - 6. Door Locks: Cylindrical locks on millwork at Locations Noted.
 - 7. Drawer Locks: Cylindrical locks on millwork at Locations Noted.
 - 8. Grommets for cable passage through countertops: 2 inch OD, molded-plastic grommets, color selected from manufacturer's full range, with 3/4-inch (19-mm) hole and plastic cap with slot for wire passage thru plastic laminate surfaces or as specified in drawings.
 - 9. Wardrobe Rail: 1 5/16" diameter wardrobe rail, with supports, chrome finish.
 - a. Manufacturer:
 - 1) Hafele
 - 10. Heavy Duty Shelf Bracket:
 - a. Basis of Design: Knappe and Vogt #182 Series Heavy Duty Shelf Bracket, Color: Titanium.
 - b. Or Prior Approved
 - 11. Fixed Specialty Brackets:
 - a. Basis of Design: Doug Mocket Worksurface Support, SWS 2 Metallic Silver
 - b. Or Prior Approved Equal.
 - 12. Concealed Brackets: Powdercoated steel sized to accommodate countertop
 - a. Richelieu
 - 13. Waste/Trash Bin Glide: Hafele MX, Double Waste Bin Pull Out, Model 503.15.224. Located as indicated in Drawings.

**SECTION 06 8200
GLASS FIBER REINFORCED PLASTIC**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiber-reinforced polymer (FRP) trim.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data: Manufacturer's data for base moldings.
- C. Shop Drawings: For each type of composite trim, indicate:
 - 1. Plans and Elevations: Include dimensions and unit serial numbers; indicate location of fabricated units.
- D. Samples: For each wall panel & associated trim type, two samples, 5 inches by 5 inches (130 mm by 130 mm) in size, indicating specified color.
- E. Manufacturer's installation instructions
- F. Operation and Maintenance Data: Maintenance instructions, including recommended cleaning procedures and materials.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in architectural glass fiber and resin components with five years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site in original packages, containers or bundles bearing brand name and identification.
- B. Store products under cover, elevated above grade, and in dry, well-ventilated areas not exposed to heat or sunlight. Protect from moisture damage.
- C. Handle products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fiber-Reinforced-Polymer (FRP) Composite Trim:
 - 1. Basis of Design: Marlite: www.marlite.com.
 - 2. Crane Composites: www.cranecomposites.com
 - 3. Kal-Lite: www.kal-lite.com.
 - 4. Or prior approved equal.

2.02 MATERIALS

- A. Resin: Polyester / Acrylic Blended resin with natural fiber material, fire resistant, high workability characteristics , integral coloring additives.

2.03 SHOP FABRICATION

- A. Mold Surface: Textured to achieve pebble embossed finish.
- B. Finish trim corners, Batten strips, and edges.

2.04 FINISH

- A. Color: As indicated in Drawing Finish Key, or as selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.01 EXAMINATION

4024101 / Hahnville Branch Library	06 8200 - 1	Glass Fiber Reinforced Plastic

- A. Verify substrates are prepared to receive composite trim.
- B. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify mechanical, electrical, and other building components affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

- A. Install composite trim in accordance with manufacturer's written instructions.

3.03 TOLERANCES

- A. Maximum Variation from Level: 1/4 inch in 10 feet (2 mm in 1 m).

3.04 CLEANING

- A. Clean exposed surfaces of installed units in accordance with manufacturer's instructions.

3.05 PROTECTION

- A. Protect installed composite trim units from subsequent construction operations.

**SECTION 07 0543
CLADDING SUPPORT SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cladding support systems, insulation penetrating.

1.02 RELATED REQUIREMENTS

- A. Section 05 4000 - Cold-Formed Metal Framing.
- B. Section 07 4243-Composite Wall Panels.

1.03 REFERENCE STANDARDS

- A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2025a.
- C. ASTM A1046/A1046M - Standard Specification for Steel Sheet, Zinc-Aluminum-Magnesium Alloy-Coated by the Hot-Dip Process; 2022.
- D. ASTM C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate cladding support system manufacturer's requirements with requirements of exterior structural wall assemblies.
- B. Preinstallation Meetings:
 - 1. Schedule meeting to occur after final approval of submittals by Architect.
 - 2. Agenda: Review exterior structural wall assembly requirements and cladding fastening requirements.
 - 3. Required Attendees: Contractor, cladding support system subcontractors and cladding subcontractors.
 - 4. Invited Attendees: Owner and Architect.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's published descriptive data, including product attributes.
 - 1. Include data for cladding support system.
- C. Shop Drawings: For each cladding support system; indicate:
 - 1. Sections: Include column centers, elevations, and dimensions; indicate locations of system components, component spacings, and wall fasteners.
 - 2. Details: Connection details between cladding support systems and substrates; indicate fastener size and spacing.
 - a. Drawing Scale: 1-1/2 inches to 1 foot (1:10), minimum.
- D. Certificate: Certify cladding support systems of this section meet or exceed specified design criteria.
- E. Delegated Design Documents: Submit for information, signed and sealed documents by structural engineer of record responsible for comprehensive design package of cladding system, including wall fasteners and anchors. Submit structural design, rail spacing, and calculations sufficient to comply with structural design criteria of this section.
- F. Design Data: Submit for information, project-specific thermal performance values for above-grade walls; prepared by professional engineer; substantiate values based on alternative compliance methods described in ASHRAE Std 90.1 I-P and acceptable by AHJ.

- G. Test Reports: Submit test reports for each type of cladding support system performed by qualified testing agency for manufacturer.
- H. Manufacturer's Instructions: Submit manufacturer's written installation instructions.
- I. Manufacturer Reports: Manufacturer's field representative installation inspection reports.
- J. Designer's qualification statement.
- K. Manufacturer's qualification statement.
- L. Installer's qualification statement.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications for Contractor's Design-Related Professional Design Services: Qualified professional structural engineer experienced in design of cladding support systems and licensed in the State in which the Project is located.
- B. Designer Qualifications: Qualified professional structural engineer experienced in design of cladding support systems, associated wall fasteners and anchors, and licensed in the State in which the Project is located.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.
- D. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience and approved by manufacturer.
- E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.
- F. Documents at Project Site: Maintain at project site one copy of manufacturer's installation instructions and shop drawings.

1.07 MOCK-UPS

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Construct exterior wall assembly mock-up, including cladding support systems as indicated on drawings.
- C. Locate where directed.
- D. Mock-up may remain as part of work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver products to project site in wrapped, protected, unbroken packaging with product identification labeling.
- C. Store products under cover and elevated above grade.
- D. Handle products without damaging; prevent bending, warping, and twisting to surfaces, edges, or corners.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty against structural failure of cladding support system. Complete forms in Owner's name and register with manufacturer.
- C. Manufacturer's Special Warranty: Provide 10-year warranty for cladding support system components, including structural failure of components, commencing on Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.
- D. Installer Warranty: Provide 2-year warranty against installation defects commencing on Date of Substantial Completion. Complete forms in Owner's name and register with installer.

PART 2 PRODUCTS

2.01 CLADDING SUPPORT SYSTEMS, INSULATION PENETRATING

- A. Hat-Shaped, Metal Rail Systems:
 - 1. Description: Square-shaped hat-channel rails perforated with vent holes; flanges with stiffening lips and fastener holes.
 - 2. Applications:
 - a. Insulation-Penetrating Cladding Support Systems: Channel flanges mount over rigid foam plastic exterior continuous insulation; wall fasteners penetrate insulation and attach to steel-framed exterior structural wall assemblies.
 - 3. Material: Metallic-coated steel sheet; CP90 coating designation in accordance with AISI S240.
 - 4. Material: Zn-Al-Mg coated steel sheet in accordance with ASTM A1046/A1046M.
 - a. Thickness: 16 gauge, 0.0598 inch (1.52 mm).
 - 5. Material: Stainless steel sheet.
 - a. Stainless Steel Thickness: 16 gauge, 0.0625 inch (1.59 mm).
 - 6. Depth: 7/8 inch (22 mm).
 - 7. Flange Width: Two equal flanges, each 1-1/2 inches (38 mm) wide.
 - 8. Total Width: 5 inches, nominal (125 mm).
 - 9. Orientation: Vertical.
 - 10. Products:
 - a. Basis of Design: ClarkDietrich; ProChannel Ci with Grip-Deck TubeSeal Technology: www.clarkdietrich.com/#sle.
 - b. Knight Wall Systems; HCI System: www.knightwallsystems.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Stainless Steel Sheet:
 - 1. ASTM A240/A240M; Type 304.

2.03 FABRICATION

- A. Shop fabricate to greatest extent possible.

2.04 ACCESSORIES

- A. Wall Fasteners:
 - 1. Manufacturer's corrosion-resistant-coated steel wall fasteners for attaching cladding support systems to steel-framed structural wall assemblies.
 - a. Comply with ASTM C1513.
 - b. Structural Performance: Manufacturer's wall fasteners; type, spacing, and embedment in accordance with Contractor-provided structural design of cladding system.
 - c. Thermal Performance: Manufacturer's wall fasteners with thermally isolated polymer washers.
- B. U-Shaped Window Perimeter Support:
 - 1. Description: U-shaped rail composed of composite metal and extruded plastic; rails penetrate insulation.
 - 2. Attachments to Substrate: Manufacturer's recommended fasteners attach rails to steel-framed exterior wall assemblies.
 - 3. Applications: Cladding and insulation support system for perimeters of windows and other openings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:

1. Verify substrates comply with contract documents, including specified tolerances, and are ready to receive work of this section.
 2. Verify air barrier, wall flashing, and rigid insulation work comply with contract documents.
- B. Do not commence installation until noncompliant conditions have been corrected.

3.02 PREPARATION

- A. Protection of In-Place Conditions: Protect air barrier work from damage.
- B. Surface Preparation:
1. Prepare substrate surfaces using methods in accordance with cladding support system manufacturer's written instructions.

3.03 INSTALLATION

- A. Installation of Cladding Support System Substrates.
1. See Section 05 4000 for installation of cold-formed, steel-stud framing wall substrates.
- B. Installation of cladding systems:
1. See Section 07 4243 for installation of Composite Wall Panels.

3.04 TOLERANCES

- A. Install cladding support systems plumb with noncumulative maximum variation of:
1. 1/4 inch in 20 feet (1 mm in 1 m).
- B. Install cladding support systems level with noncumulative maximum variation of:
1. 1/4 inch in 20 feet (1 mm in 1 m).

3.05 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.

3.06 CLEANING

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

3.07 PROTECTION

- A. Protect installed cladding support systems from subsequent construction operations.

**SECTION 07 0553
FIRE AND SMOKE ASSEMBLY IDENTIFICATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.02 REFERENCE STANDARDS

- A. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.
- C. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 FIELD CONDITIONS

- A. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

PART 2 PRODUCTS

2.01 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

- A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC).
- B. Languages: Provide sign markings in English.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Locate markings as required by ICC (IBC).
- B. Install neatly, with horizontal edges level.
- C. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

SECTION 07 2100 THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at cavity wall construction and over roof deck and at exterior applications, as indicated in drawings.
- B. Batt insulation in wall construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.

1.03 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
- D. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- G. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.
- H. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials
- I. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies; 2024.
- J. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, product limitations, and accessories required for installation..
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
- E. Installer Qualifications: All products listed in this section are to be installed by a single Installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.
- F. Mock-Up: Provide a mock-up for evaluation by the Architect of surface preparation techniques and application workmanship.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.
- B. Do not install joint sealants, joint tapes, transition tape, or flashing materials on to dirty board insulation.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation Over Metal Stud Framed Walls, Continuous: Polyisocyanurate board.
- B. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.
- C. Insulation over Roof Deck: Polyisocyanurate board.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
 - 1. Classifications:
 - a. Type II: Faced with either organic felt facers or glass fiber mat facers on both major surfaces of the core foam.
 - 1) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
 - 2) Thermal Resistance, R-value (RSI-value): At 1-1/2 inch (38.1 mm) thick; Class 1, Grades 1-2-3 - 8.4 (1.48), minimum, at 75 degrees F (24 degrees C).
 - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Water Vapor Permeance: 1.5 perm (____ ng/(Pa s sqm)), maximum, at 1 inch (25 mm) thickness, and when tested in accordance with ASTM E96/E96M, desiccant method.
 - 5. Comply with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
 - 6. Board Thickness: 1.0 inch (25 mm).
 - 7. Products:
 - a. Basis of Design: Rmax Inc; Durasheath: www.rmax.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BATT INSULATION MATERIALS

- A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.
- B. Where Sound Attenuation Blankets are located, use Mineral Wool Blanket Insulation as specified herein.
- C. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, unfaced, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 4. Thermal Resistance: R-value of 19 minimum at exterior walls.
 - 5. Thickness: As indicated on drawings, unless otherwise required to meet required R-value.
 - 6. Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com.
 - b. Johns Manville: www.jm.com.
 - c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
 - 7. Substitutions: See Section 01 6000 - Product Requirements.
- D. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, unfaced, complying with ASTM C665.
 - 1. Flame Spread Index: 0, when tested in accordance with ASTM E84.

2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
3. Manufacturers:
 - a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com/#sle.
 - b. Knauf Insulation; EcoBatt Insulation: www.knaufinsulation.com/#sle.
 - c. ROCKWOOL (ROXUL, Inc); COMFORTBATT: www.rockwool.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

- A. Insulation Joint and Flashing Components:
 1. General - Joint Treatment and Flashing Components:
 - a. Material Standards: As approved by Manufacturer of Polyisocyanurate (ISO) Board Insulation
 - 1) AAMA 711: For self-adhered flashing and joint materials
 - 2) AAMA 714: For liquid applied flashing and joint materials.
 - b. Liquid Flashing for Stationary Joint Treatment of Faced Polyisocyanurate Insulation:
 - 1) Rmax R-SEAL 200 LF with Rmax Inc
 - 2) LiquidArmor CM Flashing and Sealant with DOW THERMAX (ci) Exterior Insulation
 - c. Joint Sealant Tape for Stationary Joint Treatment
 - 1) Rmax R-SEAL 3000 tape
 - d. Flashing and Transition Tape for Joints Subject to Movement, at fastener penetrations, and openings and transition to other building materials
 - 1) Rmax R-SEAL 6000 tape
- B. Tape joints of rigid insulation in accordance with insulation manufacturers' instructions.
- C. Fasteners for Fastening Polyisocyanurate Wall Insulation to metal stud framed wall surfaces:
 1. Self-drilling ceramic coated screw.
 - a. Product: Rodenhouse Grip-Deck screws.
 - 1) Large-diameter, low profile pancake head, case hardened and tempered carbon steel, epoxy e-coat to comply with governing standards
 - (a) Product: TurFast; Nailboard Fasteners or comparable product. Thread Style and Point:
 - (1) SIPHD: Heavy-duty. Drill point for thick steel member applications.
 - b. Washers: Self-sealing for use with Self-drilling screws:
 - 1) Self-Sealing 2 inch diameter polymer washer, UV stabilized, tested, and approved to provide air and water resistive seal, in combination with compatible self drilling screw
 - 2) Product: Rodenhouse Thermal-Grip ci prong washer or comparable product.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Adhere 6 inches (152 mm) wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
 1. Tape seal joints between sheets.
- B. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches (406 mm) on center with manufacturer recommended mechanical fasteners, and tape joints with manufacturer's minimum 4 inches (102 mm) wide sealant tape; comply with ASTM E2357, or manufacturer's liquid applied flashing & sealant.

- C. Install boards horizontally on walls.
 - 1. Install in running bond pattern.
 - 2. Butt edges and ends tightly to adjacent boards and protrusions.
 - 3. Follow manufacturer's recommended installation details at expansion joints.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- E. Place 6 inches (152 mm) wide Manufacturer's required tape or liquid sealant at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal or liquid seal in place to ensure continuity of vapor retarder and air seal.
- F. Tape or use liquid seal at insulation board joints.
- G. Tape or use liquid seal at locations of all penetrations to attach furring strips thru insulation to steel studs.

3.03 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

- A. Board Installation Over Roof Deck, General:
 - 1. See applicable roofing specification section for specific board installation requirements.
 - 2. Fasten insulation to deck in accordance with roofing manufacturer's written instructions and applicable Factory Mutual requirements.
 - 3. Do not apply more insulation than can be covered with roofing on the same day.

3.04 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Refer to the Partition Types Sheet on the Drawings for Interior Insulation, Sound Attenuation, and Rated Partition requirements.
- D. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- E. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- F. Tape insulation batts in place.
- G. Retain insulation batts in place with spindle fasteners at 12 inches (305 mm) on center where there is no finish on the insulation to hold it in place.
- H. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

3.05 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

**SECTION 07 2726
FLUID APPLIED NON-PERMEABLE AIR BARRIER**

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. General Conditions, Supplementary Conditions, Instructions to Bidders and Division One General Requirements shall be read in conjunction with and govern this section.

1.02 DESCRIPTION

- A. Supply labor, materials and equipment to complete the Work as shown on the Drawings and as specified herein to bridge and seal the following air leakage pathways and gaps:
1. Connections of the walls to the roof air barrier.
 2. Connections of the walls to the foundations.
 3. Seismic and expansion joints.
 4. Openings and penetrations of window and door frames, store front, curtain wall.
 5. Piping, conduit, duct and similar penetrations.
 6. Masonry ties, screws, bolts and similar penetrations.
 7. All other air leakage pathways in the building envelope.
- B. Materials and installation methods of the primary air/vapor barrier membrane system and accessories.
- C. Materials and installation methods of through-wall flashing membranes.

1.03 REFERENCES

- A. The following standards are applicable to this section:
1. ASTM E 2178: Standard Test Method for Air Permeance of Building Materials.
 2. ASTM E 283: Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 3. E 1677 Specification for Air Retarder (AR) Material or System for Low-Rise Framed Building Walls
 4. ASTM E 330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 5. ASTM E 331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
 6. ASTM E 96: Water Vapor Transmission of Materials.
 7. CGSB 37-GP-56M: Membrane, Modified, Bituminous, Prefabricated, and Reinforced.
 8. AMMA 2400: Standard Practice for Installation of Windows with a Mounting Flange in Stud Frame Construction.
 9. ASTM E 2112: Standard Practice for Installation of Exterior Windows, Doors and Skylights.
 10. ASTM D 5590: Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay

1.04 SUBMITTALS

- A. Submit documentation from an approved independent testing laboratory certifying the air leakage and vapor permeance rates of the air barrier membranes, including primary membrane and transition sheets, exceed the requirements of the Energy Code and in accordance with ASTM E 2178.
1. Test report submittals shall include test results on porous substrate and include sustained wind load and gust load air leakage results.
- B. Submit manufacturers' current product data sheets for the air barrier membrane system.
- C. Submit manufacturer's installation Instructions.

- D. Submit document stating the applicator of the primary air/vapor barrier membranes specified in this section is qualified by the manufacturer as suitable for the execution of the Work.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with manufacturer's written instructions and this specification.
- B. Maintain one copy of manufacturer's written instructions on site.
- C. Allow access to Work site by the air barrier membrane manufacturer's representative.
- D. Components used shall be sourced from one manufacturer, including sheet membrane, air barrier sealants, primers, mastics, and adhesives.
- E. Single-Source Responsibility:
 - 1. Obtain air barrier materials from a single manufacturer regularly engaged in manufacturing the product.
 - 2. Provide products which comply with all federal, state and local regulations controlling use of volatile organic compounds (VOCs).

1.06 MOCK-UP

- A. Provide mock-up of air/vapor barrier materials under provisions of Section 01 3300 Submittls.
- B. Where directed by architect, construct typical exterior wall panel, 6 foot long by 6 foot wide, incorporating substrate, window frame, attachment of insulation and showing air barrier membrane application details.
- C. Allow 48 hours for observation of mock-up by architect before proceeding with air barrier work. Mock-up may remain as part of the Work.

1.07 PRE-INSTALLATION CONFERENCE

- A. Contractor shall convene week prior to commencing Work of this section.
- B. Ensure all contractors responsible for creating a continuous plane of air tightness are present.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Refer to current Product MSDS for proper storage and handling.
- B. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.
- C. Store roll materials on end in original packaging. Protect rolls from direct sunlight until ready for use.
- D. Store air barrier membranes, adhesives and primers at temperatures of 40 degrees F and rising.
- E. Keep solvent away from open flame or excessive heat.
- F. Wasted Management and Disposal
 - 1. Separate and recycle waste materials in accordance with Section 01 7419 - Construction Waste Management and Disposal.
- G. Contractor to verify compliance for Volatile Organic Compounds (VOC) limitations of products to comply with all federal, state and local regulations controlling use of volatile organic compounds (VOCs).

1.09 COORDINATION

- A. Ensure continuity of the air seal throughout the scope of this section.

1.10 WARRANTY

- A. Provide manufacturer's standard 10-year material warranty.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Air/vapor barrier membrane components and accessories must be obtained as a single-source from the membrane manufacturer to ensure total system compatibility and integrity.
 - 1. Acceptable Manufacturers:
 - a. Henry Company
999 N Sepulveda Blvd, Suite 800
El Segundo, CA 90245
(800) 598-7663
www.Henry.com
 - b. Grace Construction Products
 - c. Carlisle Coatings & Waterproofing - Barriseal R

2.02 MEMBRANES (BASIS-OF-DESIGN)

- A. Primary liquid air/vapor barrier membrane for temperatures above 40 degrees F shall be Air-Bloc 16MR manufactured by Henry, Perm-A-Barrier Liquid manufactured by Grace Construction Products, or approved equal; a one component elastomeric membrane, trowel or spray applied, compatibility with substrates, transition membranes and insulation. Membrane shall have the following physical properties:
 - 1. Meets the air leakage requirements of the Massachusetts Commercial Energy Code (780 CMR, Ch. 13) Energy Conservation Requirements for the Building Envelope,
 - 2. Air permeability: 0.00013 CFM/ft² @ 1.6 lbs/ft² to ASTM E 2178 and ASTM E 283 and have no increased air leakage when subjected to a sustained wind load of 10.5 lbs/ft² for 1 hour and gust wind load pressure of 62.8 lbs/ft² for 10 seconds when tested at 1.6 lbs/ft² to ASTM E 331,
 - 3. Rating 0 -No fungal growth as tested to ASTM D 5339,
 - 4. Water vapor permeance: 0.03 perms to ASTM E 96,
 - 5. VOC Content: No appreciable VOC (less than 100g/L),
 - 6. Elastic Recovery: 90% to CAN/CGSB 37.58M86,
 - 7. Meets CAN/CGSB-51-33 Type I Water Vapor Permeance requirements
- B. Self-adhering transition membrane shall be Blueskin SA, LT, or HT manufactured by Henry, Perm-A-Barrier Detail Membrane manufactured by Grace Construction Products; an SBS modified bitumen, self-adhering sheet membrane complete with a blue engineered thermoplastic film. Membrane shall have the following physical properties:
 - 1. Air leakage: <0.0001 CFM/ft² @1.6 lbs/ft² to ASTM E2178,
 - 2. Vapor permeance: 0.03 perms to ASTM E 96,
 - 3. Membrane Thickness: 0.0394 inches (40 mils),
 - 4. Low temperature flexibility: -22 degrees F to CGSB 37-GP-56M,
 - 5. Elongation: 200% to ASTM D412-modified
- C. Through-wall flashing membrane (Self-Adhering) shall be Blueskin TWF manufactured by Henry, or Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products ; an SBS modified bitumen, self-adhering sheet membrane complete with a yellow engineered thermoplastic film. Membrane shall have the following physical properties:
 - 1. Membrane Thickness: 0.0394 inches (40 mils),
 - 2. Film Thickness: 4.0 mils,
 - 3. Flow (ASTM D5147): Pass @ 212 degrees F,
 - 4. Puncture Resistance: 134 lbf to ASTM E 154,
 - 5. Tensile Strength (film): 5000 psi minimum ASTM D 882,
 - 6. Tear Resistance: 45lbs.-MD, 17lbs.-CD to ASTM D1004,
 - 7. Low temperature flexibility: -22 degrees F to CGSB 37-GP-56M

2.03 ADHESIVE AND PRIMERS

- A. Primer for self-adhering membranes at temperatures above 25 degrees F shall be Aquatacä Primer manufactured by Henry, or Perm-A-Barrier primer manufactured by Grace Construction Products; a polymer emulsion based adhesive, quick setting. Primer shall have the following physical properties:

1. Color: Aqua,
 2. Weight: 8.3 lbs/gal,
 3. Solids by weight: 53%,
 4. Water based, no solvent odors,
 5. Drying time (initial set): 30 minutes at 50% RH and 70 degrees F
- B. Adhesive for self-adhering membranes at all temperatures shall be Blueskin Adhesive manufactured by Henry, or Perm-A-Barrier adhesive approved by Grace Construction Products, a synthetic rubber based adhesive, quick setting, having the following physical properties:
1. Color: Blue,
 2. Weight: 6 lbs/gal,
 3. Solids by weight: 35%,
 4. Drying time (initial set): 30 minutes
- C. Adhesive with low VOC content for self-adhering membranes at all temperatures shall be Blueskin LVC Adhesive manufactured by Henry, or approved adhesive manufactured by Grace Construction Products; a synthetic rubber based adhesive, quick setting, having the following physical properties:
1. Color: Blue,
 2. VOC: <240 g/L,
 3. Solids by weight: 40%,
 4. Drying time (initial set): 30 minutes

2.04 JOINT TREATMENT, PENETRATION & TERMINATION SEALANT

- A. Joint Treatment, penetration and termination Sealant shall be HE925 BES Sealant manufactured by Henry; a moisture cure, medium modulus polymer modified sealing compound having the following physical properties:
1. Compatible with sheet air barrier, roofing and waterproofing membranes and substrate,
 2. Complies with Fed. Spec. TT-S-00230C, Type II, Class A,
 3. Complies with ASTM C 920, Type S, Grade NS, Class 25,
 4. Elongation: 450 – 550%,
 5. Remains flexible with aging,
 6. Seals construction joints up to 1 inch wide
- B. Alternate joint treatment fabric: HE 183 yellow open weave glass fabric or approved equal.

2.05 INSULATION ADHESIVE

- A. Insulation adhesive shall be Air-Bloc 21 Insulation Adhesive manufactured by Henry; a synthetic, trowel applied, rubber based adhesive, having the following physical properties:
1. Compatibility: With air barrier membrane, substrate and insulation,
 2. Air leakage: 0.0026 CFM/ft² @ 1.6 lbs/ft² to ASTM E283,
 3. Water vapor permeance: 0.03 perms to ASTM E96,
 4. Long term flexibility: CGSB 71-GP-24M

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready to accept the Work of this section. Notify architect in writing of any discrepancies. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrates.
- B. All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants. Fill spalled areas in substrate to provide an even plane. Strike masonry joints flush.
- C. Where curing compounds are used they must be clear resin based without oil, wax or pigments.
- D. Do not proceed with application of air barrier membrane when rain is expected within 24 hours.
- E. Condition materials to room temperature prior to application to facilitate handling.

3.02 SURFACE PREPARATION

- A. Water Based Elastomeric Emulsion Air Barrier Membrane: liquid applied water based air barrier membrane may be applied to green concrete 16 hours after forms are removed.
- B. Ensure all preparatory Work is complete prior to applying primary air barrier membrane.
- C. Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing and fastened into solid backing.

3.03 INSTALLTION OF AIR VAPOR BARRIER SYSTEM

A. JOINT TREATMENT

- 1. Seal joints $\frac{1}{4}$ inch and less between panels of exterior grade gypsum sheathing, plywood, OSB or cementitious panels with joint treatment sealant.
 - a. Fill joint between sheathing with approved joint treatment sealant ensuring contact with all edges of sheathing board. Strike flush any excess sealant over joint layer to form a continuous layer over the joint.
 - b. Seal gaps and voids or irregular joints greater than $\frac{1}{4}$ inch between panels of exterior grade gypsum, exterior grade gypsum sheathing, plywood, OSB or cementitious panels with a strip of self-adhering air/vapor barrier transition membrane lapped a minimum of 1-1/2 inches on both sides of the joint.
 - 1) Prime surfaces as per manufacturers' instructions and allow to dry.
 - 2) Align and position self-adhering air/vapor barrier transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane.
 - 3) Roll all laps and membrane with a counter top roller to ensure seal.
 - c. Alternately, joints not exceeding $\frac{1}{8}$ inch can be sealed with yellow open weave glass fabric.
 - 1) Apply yellow open weave glass fabric centered over joint followed by a $\frac{1}{8}$ inch (120mils) thick trowel application of air/vapor barrier membrane.
 - 2) Allow to dry prior to application of primary air/vapor barrier membrane.

B. INSIDE AND OUTSIDE CORNERS

- 1. Seal inside and outside corners of sheathing boards with a strip of self-adhering air/vapor barrier transition membrane extending a minimum of 3 inches on either side of the corner detail.
 - a. Prime surfaces as per manufacturers' instructions and allow to dry.
 - b. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane.
 - c. Roll all laps and membrane with a counter top roller to ensure seal.

C. CRACK TREATMENT – MASONRY AND CONCRETE

- 1. Seal cracks over $\frac{1}{16}$ inches in masonry and concrete with a strip of self-adhering air/vapor barrier transition membrane lapped a minimum of 1 1/2 inches on both sides of the crack.
 - a. Prime surfaces as per manufacturers' instructions and allow to dry.
 - b. Align and position self-adhering air/vapor barrier transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane.
 - c. Roll all laps and membrane with a counter top roller to ensure seal.
 - d. Alternately, static cracks $\frac{1}{16}$ inch to $\frac{1}{8}$ inch can be sealed with primary air/vapor barrier membrane.
 - 1) Fill crack with primary air barrier membrane.
 - 2) Allow to dry prior to application of primary air/vapor barrier membrane.

D. TRANSITION AREAS

1. Tie-in to structural beams, columns, floor slabs and intermittent floors, parapet curbs, foundation walls, roofing systems and at the interface of dissimilar materials as indicated in drawings with self-adhering air/vapor barrier transition membrane.
 - a. Prime surfaces as per manufacturers' instructions and allow to dry.
 - b. Align and position self-adhering air/vapor barrier transition membrane, remove protective film and press firmly into place. Provide minimum 3 inch lap to all substrates.
 - c. Ensure minimum 2 inch overlap at all end and side laps of membrane.
 - d. Roll all laps and membrane with a counter top roller to ensure seal.
- E. WINDOWS AND ROUGH OPENINGS
 1. Wrap rough openings with self-adhering membrane as detailed.
 - a. Prime surfaces as per manufacturers' instructions and allow to dry.
 - b. Align and position self-adhering air/vapor barrier transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inch overlap at all end and side laps of membrane.
 - c. Roll all laps and membrane with a counter top roller to ensure seal.
- F. THROUGH-WALL FLASHING MEMBRANE
 1. Apply through-wall flashing membrane along the base of masonry veneer walls and over shelf angles as detailed.
 - a. Prime surfaces and allow to dry, press membrane firmly into place, over lap minimum 2 inches at all end and side laps. Promptly roll all laps and membrane to ensure the seal.
 - b. Applications shall form a continuous flashing membrane and shall extend up a minimum of 8 inches up the back-up wall.
 - c. Seal the top edge of the membrane where it meets the substrate using termination sealant. Trowel-apply a feathered edge to seal termination to shed water.
 - d. Install through-wall flashing membrane and extend 1/2 inch from outside edge of veneer. Provide "end dam" flashing as detailed.
- G. PRIMARY AIR/VAPOR BARRIER
 1. Apply by spray or flat trowel a complete and continuous unbroken film of liquid air/vapor and rain barrier membrane.
 - a. For temperatures above 40 degrees F and rising, apply one component water based elastomeric emulsion air/vapor barrier membrane at a rate of 20 sq.ft/gallon to a uniform wet film thickness of 75 mils for smooth surfaces depending upon surface texture and porosity. For rough surfaces, apply elastomeric emulsion air/vapor barrier membrane at a rate of 14 sq.ft/gallon to a uniform wet film thickness of 110 mils depending upon surface texture and porosity.
 - b. Spray-apply or trowel around all projections and penetrations ensuring a complete and continuous air barrier membrane. Lap liquid applied membrane 1 inch over self-adhering membranes to seal leading edge.
 - c. Allow air barrier membrane to dry as per manufacturers recommendations prior to placement of insulating materials.

3.04 APPLICATION OF TERMINATION SEALANT

- A. Seal membrane terminations, heads of mechanical fasteners, masonry tie fasteners, around penetrations, duct work, electrical and other apparatus extending through the primary water resistive air barrier membrane and around the perimeter edge of membrane terminations at window and door frames with specified termination sealant.

3.05 FIELD QUALITY CONTROL

- A. Make notification when sections of Work are complete to allow review prior to covering air barrier system.

3.06 INSTALLATION OF INSULATION

4024101 / Hahnville Branch Library	07 2726 - 6	FLUID APPLIED NON- PERMEABLE AIR BARRIER

- A. Apply insulation adhesive in a serpentine pattern over the air barrier membrane.
 - 1. Dab Method: Apply walnut-sized dabs of insulation adhesive spaced 6 inches on center to substrate. Apply insulation using sufficient hand pressure to compress dabs up to 2 inches in diameter.
 - 2. Bead Method: Apply ¼ inch beads 6 inches on center in a serpentine pattern.
- B. Immediately embed insulation into the adhesive and press firmly into place to ensure full contact. Apply additional adhesive if allowed to skin over.

3.07 PROTECTION

- A. Damp substrates must not be inhibited from drying out. Do not expose the backside of the substrate to moisture or rain.
- B. Cap and protect exposed back-up walls against wet weather conditions during and after application of membrane. Drying time varies depending on temperature and relative humidity. Protect air barrier Work against wet weather conditions for a minimum of 24 hours.
- C. Air barrier membranes are not designed for permanent exposure. Good practice calls for covering as soon as possible. Special consideration must be given to the exposed un-insulated membrane during winter months of construction so as to avoid the risk of condensation.

**SECTION 07 4113
METAL ROOF PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural roofing system of preformed steel panels.
- B. Attachment system.
- C. Finishes.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.
- B. Section 07 6200 - Flashing & Sheet Metal

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- C. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2023.
- D. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus; 2024.
- E. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017 (Reapproved 2023).
- F. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2005 (Reapproved 2017).
- G. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995 (Reapproved 2024).
- H. ASTM E1680 - Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems; 2016 (Reapproved 2022).
- I. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Summary of test results, indicating compliance with specified requirements.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Specimen warranty.
- C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
 - 1. Show work to be field-fabricated or field-assembled.
- D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

- E. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches (305 mm) square, representing actual roofing metal, thickness, profile, color, and texture.
 - 1. Include typical panel joint in sample.
 - 2. Include typical fastening detail.
- F. Test Reports: Indicate compliance of metal roofing system to specified requirements.
- G. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in the manufacture of roofing systems similar to those required for this project, with not less than 5 years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.
- B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of five years from Date of Substantial Completion.
- C. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of five years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Standing Seam Metal Roof Panels:
 - 1. Basis of Design: Berridge Manufacturing Company; Double Lock Zee-Lock Panel: www.berridge.com.
 - a. Width: 16"
 - b. Depth: 2"
 - c. Panel Attachment: Concealed Fastening System
 - d. Thickness: 24 gauge
 - e. Profile: Standing Seam, 2" Tall Vertical Seam
 - f. Finish: Smooth, with striations.
 - g. Finish Coating: Fluoropolymer Two-Coat System
 - 2. Or Prior Approved Equal.

2.02 PERFORMANCE REQUIREMENTS

- A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
 - 1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
 - 2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.

3. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F (56 degrees C).

2.03 STRUCTURAL METAL ROOF PANELS

- A. Structural Metal Roofing: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
 1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
 2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
 3. Wind Uplift: Class 90 wind uplift resistance of UL 580.
 4. Air Infiltration: Maximum 0.06 cfm/sq ft (1.1 cubic meters/hr/sq m) at air pressure differential of 6.24 lbf/sq ft (300 Pa), when tested according to ASTM E1680.
 5. Water Penetration: No water penetration when tested according to procedures and recommended test pressures of ASTM E1646. Perform test immediately following air infiltration test.
 6. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F (56 degrees C).
 7. Thermal Performance: Provide thermal resistance through entire system, R-value (RSI-value) of 15 deg F hr sq ft/BTU; 2 inch thick (2.6 K sq m /W; 50.8 mm thick), when tested in accordance with ASTM C1363.
- B. Metal Panels: Factory-formed panels with factory-applied finish.
 1. Type: Double skin, factory-assembled with foamed-in-place urethane insulation.
 2. Steel Panels:
 - a. Zinc-coated SS (structural steel) sheet complying with ASTM A653/A653M; minimum G60 (Z180) galvanizing.
 - b. Steel Thickness: Minimum 24 gage (0.024 inch) (0.61 mm).
 3. Profile: Standing seam, with minimum 2.0 inch (51 mm) seam height, concealed fastener system for field seaming with special tool.
 4. Texture: Smooth.
 5. Length: Full length of roof slope, without lapped horizontal joints.
 6. Width for Standing Seam Panels: Maximum panel coverage of 16 inches (406mm)

2.04 ATTACHMENT SYSTEM

- A. Concealed System for Standing Seam Panels: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.05 FINISHES

- A. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss as selected from manufacturer's standards.

2.06 ACCESSORIES

- A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
- B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

- C. Sealants:
 - 1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
 - 2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
- D. Ice and Water Shield: High Temperature self-adhering roofing underlayment composed of two waterproofing materials - a rubberized asphalt adhesive backed by a layer of slip resistant coated high density cross laminated polyethylene film. Product shall be designed for hi-temperature materials.
 - 1. ICC ESR-1677 approval, Miami-Data Counter Product Control Approval, Florida State Approval, ASTM D3767, method A, ASTM D412, ASTM D1970, ASTM D903, ASTM E96, ASTM D461.
 - 2. Exposure Limit: 90 days.
 - 3. Thickness: 60 mils
 - 4. Manufacturers:
 - a. Grace; Ice and Water Shield HT
 - b. Henry; Blueskin PE200HT
 - c. GAF; StormGuard Ice and Water Shield 2SQ Roll
 - d. Or Approved Equal
- E. Fasteners: #12-14 X 1" self-drilling/tapping fasteners, stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Broom clean wood sheathing prior to installation of roofing system.
- B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.
- C. Coordinate installation of waterproof membrane over roof sheathing with 06 1000.
- D. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.
- E. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.
- F. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

- A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
 - 1. Install standing seam roofing system with concealed continuous clips and fasteners at 24 inches O. C. full lengths of seam, except as otherwise recommended by manufacturer for specific circumstances.
 - 2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.
- B. Accessories: Install all components required for a complete roofing assembly, including flashings, trim, moldings, closure strips, caps, rib closures, ridge closures, and similar roof accessory items.

- C. Install one layer ice and water shield on roof deck before installing preformed metal roof panels. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 6 inches and side and end laps a minimum of 18 inches. Offset seams in ice and water shield.
- D. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.
 - 1. Form weathertight standing seams incorporating concealed clips, approved by the panel manufacturer.
 - 2. Provide sealant tape or other approved joint sealer at lapped panel joints.
 - 3. Install sealant or sealant tape, as recommended by panel manufacturer, at end laps and side joints.

3.04 CLEANING

- A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

- A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
- B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

**SECTION 07 4243
COMPOSITE WALL PANELS**

PART I - GENERAL

1.01 SECTION INCLUDES:

- A. Exterior, panelized fiber cement cladding system and accessories to complete a drained and back-ventilated rainscreen.
- B. Interior fiber cement panelized cladding system and accessories.

1.02 RELATED SECTIONS

- A. Section 06 1000 - Rough Carpentry
- B. Section 07 0543-Cladding Support Systems.
- C. Section 07 2000 - Thermal Protection
- D. Section 07 2726 - Fluid Applied Non Permeable Air Barrier
- E. Section 07 6000 - Flashing and Sheet Metal
- F. Section 07 9200 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.03 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 509-14 – Voluntary Test and Classification Method of Drained and Back Ventilated Rain Screen Wall Cladding Systems
- B. ASTM International (ASTM):
 - 1. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 2. ASTM C 1185 - Standard Test Methods for Sampling and Testing Non-Asbestos Fiber Cement.
 - a. ASTM C 1186 – Standard Specification for Flat Fiber-Cement Sheets.
 - 3. ASTM E-84 - Standard Test for Surface Burning Characteristics of Building Materials.
 - 4. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 5. ASTM E 228 - Standard Test Method for Linear Thermal Expansion of Solid Materials with a Vitreous Silica Dilatometer.
 - 6. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 - 7. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- C. Florida Building Code - Test Protocol HVHZ
 - 1. Testing Application Standard (TAS) 202, 203 – HVHZ Test Procedures
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 285 - Fire Test Method for Exterior Wall Assemblies Containing Combustible Material.
- E. NFPA 268 – Ignition Resistance of Exterior Wall Assemblies.
- F. Standards Council of Canada & Underwriters Laboratories Canada (ULC):
 - 1. CAN/ULC S-102 – Standard Method of Test for Surface Burning Characteristics.
 - 2. CAN/ULC S-134 – Standard Method of Fire Test of Exterior Wall Assembly.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.

- B. Product Data: Submit manufacturer's product description, storage and handling requirements, and installation instructions.
- C. Product Test Reports and Code Compliance: Documents demonstrating product compliance with local building code, such as test reports or Evaluation Reports from qualified, independent testing agencies.
- D. Manufacturer's Details: Submit drawings (.dwg, .rvt, and/or .pdf formats), including plans, sections, showing installation details that demonstrate product dimensions, edge/termination conditions/treatments, compression and control joints, corners, openings, and penetrations.
- E. Samples: Submit samples of each product type proposed for use.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. All fiber cement panels specified in this section must be supplied by a manufacturer with a minimum of 10 years of experience in fabricating and supplying fiber cement cladding systems.
 - a. Products covered under this section are to be manufactured in an ISO 9001 certified facility.
 - 2. Provide technical and design support as needed regarding installation requirements and warranty compliance provisions.
- B. Installer Qualifications: All products listed in this section are to be installed by a single installer trained by manufacturer or representative.
- C. Mock-Up Wall: Provide a mock-up wall as evaluation tool for product and installation workmanship.
- D. Pre-Installation Meetings: Prior to beginning installation, conduct conference to verify and discuss substrate conditions, manufacturer's installation instructions and warranty requirements, and project requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Panels must be stored flat and kept dry before installation. A waterproof cover over panels and accessories should be used at all times prior to installation. Do not stack pallets more than two high. Refer to the information included on each pallet.
- B. If panels are exposed to water or water vapor prior to installation, allow to completely dry before installing. Failure to do so may result in panel shrinkage at ship lap joints, and such action may void warranty.
- C. Panels MUST be carried on edge. Do not carry or lift panels flat. Improper handling may cause cracking or panel damage.
- D. Direct contact between the panels and the ground should be avoided at all times. It is necessary to keep panels clean during installation process.
- E. Do not unpack and re-stack panels.

1.07 WARRANTY

- A. Provide manufacturer's 15-year warranty against manufactured defects in fiber cement panels. Additional 5-year extension available when refinished in year 14-15.
- B. Provide manufacturer's 15-year warranty against manufactured defects in panel finish.
- C. Warranty provides for the original purchaser. See warranty for detailed information on terms, conditions and limitations.

PART II: PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Nichiha Corporation, Nichiha USA, Inc. - Product: Architectural Wall Panel Soffit + Angles Wall. 6465 E. Johns Crossing, Suite 250, Johns Creek, GA 30097; 1.866.424.4421; www.nichiha.com.
 - 1. Basis of Design Product: Nichiha VintageWood. Wood-look panel with shiplapped edges on all sides and a factory sealant gasket to seal joints when panels fit together.
 - a. Color: Architect to select color from Manufacturer's full Range of Wood Look panels.
 - b. Profiles: Wood plank texture with three, 3/8" grooves running lengthwise, spaced 5-5/8" apart.
 - c. Accessory/Component Options:
 - 1) Manufactured Corners with 3-1/2" returns for each profile color.
 - 2) Aluminum trim options: Corner Key, Open Outside Corner, H-Mold, J-Mold, Compression Joint, Inside Corner
 - (a) Finish: To match panel color.
 - 3) Essential Flashing System: Starter, Overhang.
 - (a) Finish: As selected by the Architect from the manufacturer's full range of colors.
 - d. Dimensions:
 - 1) AWP-1818: 455mm (17-7/8") (h) x 1,818 mm (71-9/16") (l).
 - 2) AWP-3030: 455mm (17-7/8") (h) x 3,030 mm (119-5/16") (l).
 - 3) Contractor to select maximum panel sizes to minimize joints for installation.
 - 4) Long dimension shall run perpendicular to framing. Contractor to coordinate direction of framing members in order to achieve Design Intent as Indicated in Elevations
 - e. Panel Thickness: 16 mm (5/8").
 - f. Weight: AWP-1818: 35.27 lbs. per panel, AWP-3030: 57.32 lbs. per panel.
 - g. Coverage: 8.88 sq. ft. per panel (1818), 14.81 sq. ft. per panel (3030).
 - h. Factory sealed on six [6] sides.
 - i. Utilize Ultimate Horizontal Starter Track FA700 and Ultimate Clips with AWP.
 - 2. Basis of Design Product: Nichiha Illumination Series.
 - a. Profile colors: Architect to select color from Manufacturer's full Range of panels.
 - b. Profiles:
 - 1) AWP-1818 Panel: Smooth, no score lines.
 - c. Accessory/Component Options:
 - 1) Manufactured Corners with 3-1/2" returns for each profile size and color.
 - (a) Do not use AWP-1818 Corners with AWP-3030 Panels.
 - 2) Aluminum trim options: Refer to Drawings. Corner Key, H-Mold, J-Mold, Compression Joint, Inside Corner
 - (a) Finish: Custom Color, Clear Anodized, or Primed.
 - 3) Essential Flashing System: Starter, Overhang.
 - (a) Finish: Matte black.
 - d. Dimensions:
 - 1) AWP-1818: 455mm (17-7/8") (h) x 1,818 mm (71-9/16") (l).
 - e. Panel Thickness: 16 mm (5/8").
 - f. Weight: AWP-1818: 35.27 lbs. per panel, AWP-3030: 57.32 lbs. per panel.
 - g. Coverage: 8.88 sq. ft. per panel (1818), 14.81 sq. ft. per panel (3030).
 - h. Factory sealed on six [6] sides.
- B. James Hardie Building Products, Inc: www.jameshardie.com.
- C. Allura, a division of Plycem USA, Inc: www.allurausa.com/#sle.

2.02 MATERIALS

- A. Fiber cement panels manufactured from a pressed, stamped, and autoclaved mix of Portland cement, fly ash, silica, recycled rejects, and wood fiber bundles.

- B. Panel surface pre-finished and machine applied.
- C. Panels profiled along 3030mm edges so that the long joints between the installed panels are ship-lapped.
- D. Factory-applied sealant gasket added to top panel edge; all 3030mm edge joints contain a factory sealant.

2.03 PERFORMANCE REQUIREMENTS:

- A. Fiber Cement Cladding – Must comply with ASTM C-1186, Type A, Grade II requirements:
 - 1. Wet Flexural Strength: Result: 1418 psi, Lower Limit: 1015 psi.
 - 2. Water Tightness: No water droplets observed on any specimen.
 - 3. Freeze-thaw: No damage or defects observed.
 - 4. Warm Water: No evidence of cracking, delamination, swelling, or other defects observed.
 - 5. Heat-Rain: No crazing, cracking, or other deleterious effects, surface or joint changes observed in any specimen.
- B. Mean Coefficient of Linear Thermal Expansion (ASTM E-228): Max 1.0×10^{-5} in./in. F.
- C. Surface Burning (CAN-ULC S102/ASTM E-84): Flame Spread: 0, Smoke Developed: 0.
- D. Wind Load (ASTM E-330): Contact manufacturer for ultimate test pressure data corresponding to framing type, dimensions, fastener type, and attachment clips. Project engineer(s) must determine Zone 4 and 5 design pressures based on project specifics. Refer to the Drawings for Wind Loads specific to this project.
 - 1. Minimum Lateral Deflection: L/120.
- E. Water Penetration (ASTM E-331): No water leakage observed into wall cavity.
- F. Steady-State Heat Flux and Thermal Transmission Properties Test (ASTM C-518): 16mm thick panel thermal resistance R Value of 0.47.
- G. Fire Resistant (ASTM E-119): The wall assembly must successfully endure 60-minute fire exposure without developing excessive unexposed surface temperature or allowing flaming on the unexposed side of the assembly.
- H. Ignition Resistance (NFPA 268): No sustained flaming of panels, assembly when subjected to a minimum radiant heat flux of $12.5 \text{ kW/m}^2 \pm 5\%$ in the presence of a pilot ignition source for a 20-minute period.
- I. Fire Propagation (NFPA 285): Wall assembly of Nichiha AWP, Ultimate Clips and Starter Track, Tyvek Commercial Wrap, 1/2" Densglass Gold Sheathing, 16" o.c. 18 gauge steel studs, mineral wool in-cavity insulation, and interior 5/8" Type X gypsum met the acceptance criteria of NFPA 285.
- J. Fire Propagation (CAN/ULC S-134): Wall assembly of Nichiha AWP, Ultimate Clips and Starter Track, Tyvek Housewrap, 5/8" FRT plywood, 16" o.c. 2x wood studs, fiberglass in-cavity insulation, and interior 5/8" Type X gypsum met the acceptance criteria of CAN/ULC S-134.
- K. Drained and Back Ventilated Rainscreen (AAMA 509-14): System classifications: W1, V1.
- L. Florida Building Code - Test Protocol HVHZ (TAS 202, 203): Horizontal Application Design Pressure: 95 psf, Vertical Application Design Pressure: 85 psf.

2.04 INSTALLATION COMPONENTS

- A. Ultimate Clip System:
 - 1. Starter Track:
 - a. Horizontal Panel Installations - FA 700 – 3,030mm (l) galvalume coated steel.
 - 2. Panel Clips: JEL 778 "Ultimate Clip II" (10mm rainscreen for 16mm AWP) – Zinc-Aluminum-Magnesium alloy coated steel.
 - a. Joint Tab Attachments (included) – used at all AWP-1818 panel to panel vertical joints, NOT used with AWP-3030 installations.

3. Corner Clips: JE 777C (10mm rainscreen for 5/8" AWP Manufactured Corners) -- Zinc-Aluminum-Magnesium alloy coated steel.
 4. Single Flange Sealant Backer – FHK 1015 R (10mm) – 6.5' (l) fluorine coated galvalume.
 5. Double Flange Sealant Backer – FH 1015 R (10mm) – 10' (l) fluorine coated galvalume.
 6. Corrugated Spacer – FS 1005 (5mm), FS 1010 (10mm) – 4' (l).
- B. Essential Flashing System (optional):
1. Starter – main segments (3,030mm), inside corners, outside corners
 2. Overhang – main segments (3,030mm), inside corners, outside corners, joint clips
- C. Fasteners: Corrosion resistant fasteners, such as hot-dipped galvanized screws appropriate to local building codes and practices must be used. Use Stainless Steel fasteners in high humidity and high-moisture regions. Panel manufacturer is not liable for corrosion resistance of fasteners. Do not use aluminum fasteners, staples or fasteners that are not rated or designed for intended use. See manufacturer's instructions for appropriate fasteners for construction method used.
1. For installation at metal studs, screws must penetrate solid structure by a minimum of 1/2" (13mm). Three threads are needed for effective grab.
 2. For installation furring to masonry. Fastener type, size, and spacing to be determined under direction of an engineer and in accordance with local building codes. Screws must penetrate wood furring a minimum of 1" (25mm) or steel by 1/2" (13mm).
- D. Flashing: Flash all areas specified in manufacturer's instructions. Do not use raw aluminum flashing. Flashing must be galvanized, anodized, or PVC coated.
- E. Sealant: Sealant shall comply with ASTM C920, Class 35.

PART III: EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
1. Allowable stud spacing: 16" o.c. maximum.
 2. A weather resistive barrier is required when installing fiber cement panels. Use an approved weather resistive barrier (WRB) as defined by the current code requirements. Refer to local building codes.
 3. Appropriate metal flashing should be used to prevent moisture penetration around all doors, windows, wall bottoms, material transitions and penetrations. Refer to local building codes for best practices.
- B. Examine site to ensure substrate conditions are within alignment tolerances for proper installation.
- C. Do not begin installation until unacceptable conditions have been corrected.
- D. Do not install panels or components that appear to be damaged or defective. Do not install wet panels.

3.02 TOLERANCE

- A. Wall surface plane must be plumb and level within +/- ¼ inch in 20 feet in any direction.
1. One layer of Manufacturer's standard 5mm (~3/16") Spacer may be used as shim.

3.03 INSTALLATION

- A. General: Install products in accordance with the latest installation guidelines of the manufacturer and all applicable building codes and other laws, rules, regulations and ordinances. Review all manufacturer installation, maintenance instructions, and other applicable documents before installation.
1. Consult with the manufacturer before installing any fiber cement product on a building higher than 45 feet or three stories or for conditions not matching prescribed standard installation guide requirements and methods. A Technical Design Review (TDR) process is available to evaluate project feasibility.

2. Vertical Control/Expansion Joints are required with AWP-1818 (or equal product by approved manufacturer), for walls wider than 30 feet, within 2-12 feet of outside corners finished with metal trim and approximately every 30 feet thereafter.
 3. Vertical Control/Expansion Joints are required at each AWP-3030 (or equal product by approved manufacturer) vertical joint, or H-Mold trim may be used instead.
 4. Horizontal/Compression Joints are required for multi-story installations of AWP. Locate joints at floor lines. Joints are flashed minimum ½" breaks. Do not caulk. Refer to installation guide(s).
 - a. Wood framed buildings of three or more floors require a compression joint at each floor.
 - b. Steel framed buildings (including reinforced concrete core with LGMF exterior walls) of more than three floors (or 45 feet) require a compression joint every 25 feet at a floor line.
- B. Panel Cutting
1. Always cut fiber cement panels outside or in a well ventilated area. Do not cut the products in an enclosed area.
 2. Cut panels with the face down.
 3. Always wear safety glasses and NIOSH/OSHA approved respirator whenever cutting, drilling, sawing, sanding or abrading the products. Refer to manufacturer SDS for more information.
 4. Use a dust-reducing circular saw with a diamond-tipped or carbide-tipped blade.
 - a. Recommended circular saw: Makita 7-1/4" Circular Saw with Dust Collector (#5057KB) or equal.
 - b. Recommended blade: Tenryu Board-Pro Plus PCD Blade (#BP-18505) or equal.
 - c. Shears (electric or pneumatic) or jig saw can be used for complicated cuttings, such as service openings, curves, radii and scrollwork.
 5. Silica Dust Warning: Fiber cement products may contain some amounts of crystalline silica, a naturally occurring, potentially hazardous mineral when airborne in dust form. Consult product SDS or visit <https://www.osha.gov/dsg/topics/silicacrystalline/>.
 6. Immediately clean dust from cut panels as it may bind to the finish.
 7. Cut and exposed panel edges shall be primed or sealed with fiber cement sealer, DryLock or approved equal - or - latex paint such as Kilz Premium or Kilz Max. Do not use Color Xpressions touch up paint for edge sealing as there will not be enough for larger projects.
- C. Install all trim, single and double flange sealant backer prior to installing panels.
- D. Cutting the panel clips: Where conditions require that the clip must be cut to accommodate panels or corner pieces in smaller areas or segments, cut with a non-ferrous saw blade on a band or chop saw. The smallest segment must include at least one downward engagement flange.
- E. Position starter track level and a minimum panel clearance of 6" above finished soil grade per local codes. When installing over a hard surface such as a sidewalk, a 2" panel edge clearance is acceptable. Keep panel at least 1" above steep slope roofs. The panel face edge will extend 3/4" below the starter track. Install starter track at every stud line (maximum 16" o.c.).
- F. When panels necessitate a partial panel at the bottom of the wall, it is best to add the cut panel below the starter track. Face fasten bottom edge of the panel, one inch up from the cut edge. Fasten the top edge of the panel per manufacturer's instructions.
- G. Continue to add courses of panels per manufacturer's written instructions. Install full sized course up under the Starter and fasten upside down panel clips underneath, with every framing/furring member covered by a clip. Pre-drill fastener holes for clips used upside down. Add next course and fasten upside down clips unless that panel is the final/terminal, cut/scribed course. Place panels next to the installed panel, making sure the ship lap joint fits tightly together. A rubber mallet or block of wood may be used to seat the panels firmly in place and tighten to the left. Do not hammer directly anywhere on the panels. At last course fasten

spacer to wall where last panel will terminate. Cut panels to properly fit at termination line. Face fasten at the studs through the spacer all along the top using bugle head screws.

- H. Install starter tracks above large openings (full panel width or wider). Maintain at least 1/4" clearance for panel edges above horizontal flashings, storefront frames, trim, etc.
- I. Provide vertical control/expansion joints at on walls wider than 30 feet.
- J. Provide horizontal control/expansion joints at walls taller than 45 feet.
- K. Apply sealant per manufacturer's written instructions.
- L. Fill all counter sunk fastener holes with exterior patching compound/filler such as MH Ready Patch, or approved equal, and touch-up paint with cotton swabs to match panel color.
- M. Soffit / Angled Wall Installation:
 - 1. Install in accordance with manufacturer's written recommendations.
 - 2. Provide blocking as needed to enable clip and face fastening of panels. Framing spacing shall be no greater than 16" o.c.
 - 3. Clips and tracks shall be used for installation at soffit and angled wall panel installation but face fastening is also required at each framing member along the centerline of each panel.
 - 4. With angled wall applications, ensure starter track and panels are horizontal/level. Check with laser level regularly.
 - 5. Treat all cut panel edges by coating them with exterior acrylic latex paint.
 - 6. Soffit Installation:
 - a. Begin soffit installation by measuring and adding spacers to the framing or sheathing where the centerlines of each panel course will occur, accounting for the soffit depth, number of panel courses and reduced/cut panels.
 - b. At the wall-soffit angle / intersection, secure the first edge of panel using one of the the following methods:
 - 1) Position the starter track to allow for the panel shiplap edge which will extend 3/4" past the track. Fasten the track to framing every 16".
 - 2) Remove the panel shiplap and face fasten through spacer, keeping 1" from the panel edge.
 - c. Add clips to the panel edges for additional courses in the same fashion as normal wall installation. Fasten clips to framing every 16". Utilize joing tab attachments for panel normally. Ensure panel edges are fully seated within the clips and joints are closed in moderate contact.
 - d. Along the centerline of each panel course, face fasten at intermediate framing members (filed) every 16" o.c.
 - e. The terminal edge must be cut and secured via face fasteners through spacers. Add screws every 16" keeping 1" from the cut edge. J-Mold trim may be utilized with cut panel edges.
 - f. Pre-drill the panels at face fastener locations with countersink bit.

3.04 CLEANING AND MAINTENANCE

- A. Review manufacturer guidelines for detailed care instructions.

3.05 PROTECTION

- A. Where sidewalks are poured after panel installation, Contractor shall cover and protect panels near grades. Cement dried on panels cannot be removed and will be required to be replaced at Contractor's expense.

**SECTION 07 5200
MODIFIED BITUMINOUS MEMBRANE ROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Modified bituminous roofing membrane, conventional application.
- B. Insulation, flat and tapered.
- C. Vapor retarders.
- D. Cover boards.
- E. Base flashings.
- F. Roofing cant strips and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood Blocking and Curbing.
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashings, reglets.
- C. Section 07 7100 - Roof Specialties: Counterflashings.
- D. Section 07 7200 - Roof Accessories: Prefabricated curb for mechanical equipment.

1.03 REFERENCE STANDARDS

- A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- B. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2023).
- C. ASTM D312/D312M - Standard Specification for Asphalt Used in Roofing; 2016a (Reapproved 2023).
- D. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2015a (Reapproved 2021).
- E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2024).
- F. FM (AG) - FM Approval Guide; Current Edition.
- G. FS HH-I-526 - Insulation Board, Thermal (Mineral Fiber).
- H. FS-HH-I-529 - Insulation Board, Thermal (Mineral Aggregate).
- I. FS-HH-I-530 - Insulation Board, Thermal (Urethane).
- J. FS-HH-I-551 - Insulation Block and Boards, Thermal (Cellular Glass).
- K. FS-LLL-I-535 - Insulation Board, Thermal (Cellulose Fiber).
- L. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.
- M. UL (FRD) - Fire Resistance Directory; Current Edition.
- N. Sheet Metal and Air-Conditioning Contractors National Association, Inc. (SMACNA).
- O. CGSB 37GP56M Classification: Type 2, Class C, Grade 1.

1.04 CONTRACTOR'S QUALIFICATIONS

- A. Applicator Qualifications: Approved by the manufacturer prior to the bidding period and throughout the installation and able to present a copy of his certification upon request by the Architect or Owner.
 - 1. Applicator must have installed at least five roofs with similar materials and methods specified for this project that have been warranted for the same number of years as

required under this specification by the manufacturer of the product that will be used in the Work.

2. Letter from manufacturer certifying contractor approval to be submitted at time of Bid along with requested warranty specimen.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for roof assembly fire hazard requirements, and:
 1. Underwriters Laboratories, Inc. (UL):
 - a. Class A Fire Hazard Classification.
 2. Meet local IBC Codes for project's location.

1.06 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of associated flashings and counterflashings installed by other sections.
- B. Pre-Roofing Conference:
 1. Roofing pre-construction conference to be held at the project site after approval of submittal data, and at least seven (7) calendar days prior to the start of the roofing work.
 2. Required attendees shall not be less than the Owner's Project Manager, the Architect, the General Contractor's Superintendent, the Roofing Subcontractor Foreman, the Roof System Manufacturer's Technical Representative, and the Foreman of any other Subcontractor performing work on, or providing equipment requiring coordination with the roof activities such as the HVAC Subcontractor.
 3. Requirements and Agenda for Pre-Roofing Conference:
 - a. Review in detail Architect's specifications, roof plans and roof/flashing details.
 - b. If a manufacturer's specification is used, review, and resolve all deviation or differences from the Architect's specifications.
 - c. Review and understand Factory Mutual and Underwriters Laboratories requirements and resolve all conflicts between FM and UL specifications and the project specifications.
 - d. Review roof plans; for slope, deck type, drainage, membrane attachment, expansion joints, flashing and details. Resolve all conflicts between what is considered good roofing practice and the specifications.
 - e. Review roofing system and recommended work practices for the installation.
 - f. Study plans to determine whether any roof areas have any different requirements.
 - g. Designate which areas on site will be available to use as storage/working areas.
 - h. Review procedures followed to provide proper protection of the roof system during and after construction of the roof.
 - i. Observe and make notes of job conditions prior to installation.
- C. Preinstallation Meeting: Convene one week before starting work of this section.
 1. All parties responsible for work of this section are required to attend including the Architect, Owner, Contractor, Manufacturer and Installer.
 2. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.07 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog data for membrane and bitumen materials, base flashing materials, insulation, and surfacing.
- C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and mechanical fastener layout
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Manufacturer's Certification that installer is certified by Manufacturer to install roofing system.

- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- G. Specimen of manufacturer's inspection reports.

1.08 QUALITY ASSURANCE

- A. Perform work in accordance with manufacturer's instructions.
- B. Submit certification by the manufacturer of the system materials used that these Specifications and the Drawing Details are acceptable to them for the deck and surfacing to which they are to be applied.
 - 1. If details for any manufacturer's systems proposed in the Contract Documents are not acceptable to the manufacturer, submit corresponding details proposed for the particular application, together with the manufacturer's reasons for not accepting the conditions depicted in the Specifications or Drawings. No alternate details will be considered without evidence of valid objections on the part of the manufacturer to the Contract requirements.
 - 2. No deviation is to be made from this Specification without prior written approval by the manufacturer; submit such approval to the Architect.
- C. Inspection: Prior to, during installation and at completion of the installation, an inspection shall be made by a representative of the manufacturer in order to ascertain that the roofing system has been installed according to their published specifications, standards and details.
 - 1. Warranty will be issued upon approval of the installation.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all materials and store in their unopened original packaging, bearing the manufacturer's name, related standards and any other specification or reference accepted as standard.
 - 1. When stored outdoors, insulation is to be stacked on pallets or dunnage at least four (4) inches above ground level and covered with "non-sweating" tarpaulins.
- B. Protect and permanently store all materials in a dry, well-vented and weatherproof location. Only materials to be used the same day shall be removed from this location. During winter, store materials in a heated location with a 50 degrees F minimum temperature, removed only as needed for immediate use. Keep materials away from open flame or welding sparks.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- D. Carefully store on end materials delivered in rolls with selvage edges up, a minimum of 6-inches above grade. Store metal flashings and counterflashings in such a way as to prevent wrinkling, twisting, scratching and other damage.
- E. Avoid stockpiling of materials on roofs without first obtaining acceptance from an Architect/Engineer.

1.10 FIELD CONDITIONS

- A. Surfaces on which the roofing membrane system is to be applied shall be clean, smooth, dry, free of fins, sharp edges, loose and foreign materials, oil and grease.
 - 1. Before beginning work, a representative of the manufacturer shall examine the roof surfaces in order to ensure that the substrate is acceptable.
 - 2. Do not begin installation until all defective conditions have been corrected.
 - 3. All surface voids greater than 1/4" wide shall be properly filled with an acceptable fill material.
- B. Do not apply roofing membrane during unsuitable weather.
- C. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C).
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- F. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.11 WARRANTY

- A. See Section 01 7700 - Closeout Procedures, for additional warranty requirements.
- B. Roof System (includes roofing, insulation, related flashings, edge metal, coping metal, and incidental roof system construction components): Manufacturer's 20-year, NO DOLLAR LIMIT, to cover materials and labor to repair any leaks and/or failures occurring within the warranty period. It is the intent that all the roofing accessories be manufactured and/or fabricated in a manner such that the roofing warranty will provide coverage for the roofing accessories.
- C. Manufacturer's inspection reports by the manufacturer's technical personnel must be submitted to Architect for final approval of the roof system application.
- D. The Contractor is to cover damages to the building resulting from failure to prevent penetration of water during construction.
- E. The Contractor is to guarantee all work against defects in materials and workmanship for a period of 2 years following final acceptance of the Work.
- F. Correct defective Work within a two year period after Date of Substantial Completion.
- G. Provide twenty year No Dollar Limit manufacturer's material and labor warranty to cover failure to prevent penetration of water. Warranty shall cover the total roofing system including the coating system.

1.12 LABORATORY TESTING

- A. Upon request from the Owner or Architect the elastomeric membrane manufacturers shall supply, at their expense, the results of mechanical and chemical testing performed on the elastomeric cold adhesive materials supplied.
- B. The Owner reserves the right to make other independent tests of the in-place roofing. If tests prove satisfactory, all costs shall be borne by the Owner; if tests prove unsatisfactory, all costs for testing activities and remedial work to satisfy contract criteria, and retesting activities shall be borne by the General Contractor.
- C. The tests shall be performed to certify compliance with the standards referenced under this section.

1.13 SITE PROTECTION

- A. During roofing work, exposed surfaces of finished walls shall be protected with tarps in order to prevent damage. Contractor shall assume full responsibility.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Membrane Materials:
 - 1. Basis of Design Product: Soprema Roofing and Waterproofing, Inc., www.soprema.com: System #3248, (Torch Applied), Flashing System #3250, (Torch Applied), or comparable system by one of the following:
 - 2. Siplast, Inc. Paratech 180 Base TG / Paratech 180 Cap FR TG.
 - 3. JohnsManville: Dynaweld 180S/Dynaweld Cap 180 FR
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation:
 - 1. Any insulation made by the selected roof membrane manufacturer, as listed above.
 - 2. Atlas Roofing Corporation: www.atlasroofing.com.
 - 3. Hunter panels.
 - 4. Or prior approved equal.

2.02 MEMBRANE AND SHEET MATERIALS

- A. Membrane: Polymer modified asphalt, reinforced with non-woven fabric; granule surfaced; with the following characteristics:
- B. Membrane Base Sheet - Soprema Sopra G or Siplast SA Vapor Barrier, or as recommended by roof system manufacturer.
1. To be installed loose laid over metal deck conditions.
- C. Membrane Base Ply: Soprema (#32) - **Sopralene Flam 180**
Siplast, Inc. Paratech 180 Base TG
JohnsManville - Dynaweld 180S
1. Description: SBS modified waterproofing membrane shall have a non-woven polyester reinforced and thermofusible plastic film.
 2. Components: Reinforcement shall be 3.68 lbs/sq. non-woven polyester. Elastomeric asphalt shall be a mix of selected bitumen and SBS thermoplastic polymer.
 3. Physical Properties:
 - a. Tensile Strength:
 - 1) Longitudinal - 119 lbs./in.
 - 2) Transversal - 88 lbs./in.
 - b. Ultimate elongation:
 - 1) Longitudinal - 58%
 - 2) Transversal - 64%
 - c. Static puncture strength - 67 lbs.
 - d. Low temperature flexibility, no cracking at -22 degrees F.
 - e. SBS elongation - 1500%
 - f. Load strain product:
 - 1) Longitudinal - 6902
 - 2) Transversal - 5632
 - g. Approximate roll weight - 84 lbs (38.1 kgs)
 - h. Approximate thickness - 90 mils (2.2 mm)
- D. Membrane Top Ply: Soprema (#48) **SOPRALENE FLAM 180 GR FR**
Siplast, Inc. Paratech 180 Cap FR TG
JohnsManville - Dynaweld Cap 180 FR
1. Description: SBS waterproofing membrane shall have a non-woven polyester reinforcement and thermofusible plastic film. The top side shall be self-protected with colored granules. This membrane is to be torch applied.
 - a. Color to be selected by Architect from manufacturer's full range.
 2. Components: Reinforcement shall be 3.68 lbs/sq non-woven polyester. Elastomeric cold adhesive shall be a mix of selected bitumen and SBS thermoplastic polymer.
 3. Physical Properties:
 - a. Tensile strength:
 - 1) Longitudinal - 119 lbs./in.
 - 2) Transversal - 88 lbs./in.
 - b. Ultimate elongation:
 - 1) Longitudinal - 58%
 - 2) Transversal - 64%
 - c. Static puncture strength - 67 lbs.
 - d. Low temperature flexibility, no cracking at -22 degrees F.
 - e. SBS elongation - 1500 %
 - f. Load strain product:
 - 1) Longitudinal - 6902
 - 2) Transversal - 5632

- g. Approximate roll weight - 105 lbs (47.8 kgs)
- h. Approximate thickness - 160 mils (4 mm)
- E. Flashing Membrane Base Ply: Soprema (#32) - **SOPRALENE FLAM 180**
 - Siplast - System as recommended by manufacturer.
 - JohnsManville - System as recommended by manufacturer.
- 1. Description: First membrane flashing ply shall have a non-woven polyester reinforcement and thermofusible elastomeric asphalt. Both sides to have a thermofusible plastic film. This membrane is to be applied by **heat welding only**.
- 2. Components: Reinforcement shall be 3.68 lbs/sq. non-woven polyester. Elastomeric asphalt shall be a mix of selected bitumen and SBS thermoplastic polymer.
- F. Flashing Membrane Cap Ply: Soprema (#50) - **SOPRALENE FLAM 180 GR**
 - Siplast - System as recommended by manufacturer.
 - JohnsManville - System as recommended by manufacturer.
- 1. Description: Cap membrane flashing ply shall have a non-woven polyester reinforcement and thermofusible elastomeric asphalt with fire retardant agents added. The top side shall be self-protected with colored granules. The underside shall be protected by thermofusible plastic film. This membrane is to be applied by heat welding only.
 - a. Color to be selected by Architect.
- 2. Components: Reinforcement shall be 3.68 lbs/sq. non-woven polyester. Elastomeric asphalt shall be a mix of selected bitumen and SBS thermoplastic polymer.

2.03 FASTENERS

- A. Base layer of insulation: Mechanical fasteners for securement of insulation to decking shall be approved by manufacturer. Manufacturer to provide fastening pattern and type of fastener to be used.

2.04 WOOD BLOCKING

- A. All nailers and blocking material to be free of wane, shake, decay or checks, and pressure-treated with water-borne preservatives for above ground use, AWPB LP-2.
 - 1. Blocking shall be not less than Construction Grade, Southern Pine.

2.05 COVER BOARDS

- A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
 - 1. Thickness: 1/2 inch (12.7 mm), fire-resistant.
 - 2. Products:
 - a. Georgia-Pacific; DensDeck Prime Roof Boards with EONIC Technology: www.densdeck.com/#sle.
 - b. National Gypsum; DEXcell Glass Mat Roof Board: www.nationalgypsum.com
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ROOF INSULATION

- A. Rigid insulation base layer thickness shall be as indicated on roof plan, Polyisocyanurate-Foam Board Insulation, at locations as indicated on drawings, to achieve an average R value of R-30. Insulation may be applied in one layer using 4' x 4' or 4' x 8' boards. This insulation must have a minimum compressive strength of 25 psi.
 - 1. Polyisocyanurate.
- B. At metal deck, mechanically fasten the first layer of insulation and subsequent tapered insulating system at crickets and 1/2" cover board over metal deck.
- C. Tapered Insulation (see above for approved polyiso manufacturers for warranty).
 - 1. The tapered insulation system shall have a minimum thickness of 1/2" and an average LTTR, (Long Term Thermal Resistance) value of 4.5 1/2 inch to 1 inch, Mark AA.
 - 2. The roof shall have a slope of not less than 1/4":12 and a minimum thickness as indicated on drawings.

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3. The tapered boards shall be factory formed units of the specified insulation board.
- D. Cover board shall be installed over insulation with long joints in continuous straight lines with end joints staggered a minimum of 12" away from joints of insulation.
- E. Crickets
 1. Crickets shall be installed where shown on the drawings, sloping to valleys to prevent water accumulation.
 2. Crickets shall be constructed from factory formed units of the specified insulation board.
- F. Drain Sumps
 1. 1/2":12" tapered insulation board for installation of drain sumps.

2.07 PRIMER

- A. Asphalt Primer - Soprema - **ELASTOCOOL 500**
 Siplast - PA-1125 Asphalt Primer
 JohnsManville - JM Asphalt Primer
 1. Primer shall be applied on all dissimilar materials except insulation.
 2. Description: Black bituminous varnish.
 3. Composition: Asphalt modified bitumen with thermoplastic polymers and volatile solvents.

2.08 WALKWAYS

- A. Walkway Pads: Reinforced asphaltic composition pads with slip-resisting mineral-granule surface, manufactured as a traffic pad for foot traffic and acceptable to roofing system manufacturer, 1/2 inch thick, minimum.
 1. Pad Size: 4 ft x 4 ft minimum.
- B. Walkway Cap Sheet Strips: ASTM D 6163 or ASTM D 6164, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers or reinforced with polyester fabric); granular surfaced; suitable for application method specified, and as follows:
 1. Granule Color: To match color of roofing system granules.

2.09 MISCELLANEOUS

- A. Expansion Joint System: SOPRAJOINT, Expandoflash, or equal as produced by the membrane manufacturer.
 1. Cant to Wall Expansion Joint Basis of Design: ExpandOFlash Cant-to-Wall EJ
 2. Cant to Cant Expansion Joint Basis of Design: ExpandOFlash Cant-to-Cant EJ
 3. Bellow Width sized to Accommodate Joint per Manufacturer's Recommendations
 4. Membrane: EPDM (Type E), Thickness 0.060" (1.52 mm). Color: Black
 5. Closed Cell Support Foam Thickness sized to accommodate bellow width per Manufacturer's Recommendations.
 6. Flange: Stainless Steel, .018" (0.46mm)
 7. Provide insulated model to maintain R-Value of roof.
- B. Water Cut-Off Mastic: Sopracolle 300, SBS Elastic cement, Sopramastic 200, MBR Cold Application Adhesive, or equal as approved by the membrane manufacturer.
- C. Gusset Material: Sopralene 180 Flam, Sopralene Flam Stick, DynaWeld 180 S or equal as approved by the membrane manufacturer.
- D. Silicone-Based Roof Coating System (Basis of Design): Alsan Coating SIL 402, by Soprema. Install per the manufacturer's written instructions, and in coordination with the manufacturer's representative. 20 year Coating Application = 2.5 gallons per square which is 48 mils (wet film thickness) with a dry film thickness of 44 mils. Roof coating system shall come from and be compatible with the manufacturer of the selected rood system.
 1. Coating System Components:
 - a. Alsan Coating SIL 402, by Soprema.
 - b. Alsan Coating SIL 402 Flashing, by Soprema.
 - c. Alsan Coating Asphalt Bleed Blocking Primer, by Soprema.

2. Or a silicone coating system that is compatible with the specified roofing system from the following manufacturers:
 - a. Siplast: GAF Unisil Silicone Coating
 - b. Johns Manville: JM Coating Silicone

PART 3 EXECUTION

3.01 SURFACE INSPECTION AND PREPARATION

- A. Before commencing work, all surfaces shall be smooth, clean, dry and free of any debris that would adversely effect the installation of the membrane.
 1. See 1.10 of this Section - Field Conditions.
- B. Before commencing work, the manufacturer's technical representative, together with the roofing contractor, shall inspect and approve the deck condition (slopes and nailing supports if applicable) as well as verticals on parapet walls, roof drains, stack vents, vent outlets and others, building joints, etc. If applicable, a non-compliance notice shall be submitted to the Contractor so that adjustments can be made. Commencement of work shall imply acceptance of surfaces and conditions.
- C. Verify that the work of other trades has been properly completed.
- D. Do not install materials in conditions of inclement weather.
- E. Silicone coating system note: The roof membrane cap sheet must be installed and set out a minimum of 30 days prior to coating the new roof.

3.02 SURFACE PREPARATION

- A. (Metal Deck): Verify slope and condition of metal decking.
- B. Clean substrate of dust, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- C. 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.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

- A. Install roofing membrane on clean and dry surfaces, in accordance with the manufacturer's requirements and recommendations.
- B. Perform roofing work on a continuous basis as surface and weather conditions allow.
- C. Protect adjoining surfaces against any damage that could result from roofing installation.
- D. Install only as much roofing as can be completed in one day. If weather conditions do not permit such completion, exposed areas shall be temporarily weatherproofed to prevent any water or snow infiltration from damaging other materials already installed, in particular, the thermal insulation.

3.04 EQUIPMENT

- A. Maintain all equipment and tools in good working order.

3.05 INSTALLATION OF INSULATION

- A. Comply with roofing system manufacturer's written instructions for installing roof insulation.
- B. Install insulation in Insulation Adhesive per manufacturer's requirements to meet the required uplift and fire ratings. The insulation board surface shall provide a smooth surface to accept Securock cover board.
- C. Apply only as much insulation and cover board to the roof as can be covered the same day with roofing membrane. At the conclusion of each day's work, seal exposed edges of the insulation. Cut and remove seal upon continuation of the work.

- D. No insulation piece shall be less than twelve by twelve inches (12" x 12").

3.06 FIELD BASE PLY INSTALLATION

- A. Unroll dry base ply membrane on insulation for alignment. Each strip shall have three (3) inch side laps and six (6) inch end laps.
 - 1. Begin at low point of roof.
 - 2. Place membrane so side lap is centered on drain line.
- B. Reroll base ply (halfway) one end at a time in accordance with recommendation of roof manufacturer, onto approved substrate.
- C. Roll the membrane into a full width application of cold adhesive. The membrane must be firmly and uniformly set, without voids, into the cold adhesive.
- D. Application shall provide a smooth surface, free of air pockets, wrinkles, fishmouths or tears.
- E. Using a weighted roller seal the membrane for proper adhesion.
- F. Seal all laps by running a hot trowel along the edge of the seam.
- G. Run membrane tight up against all vertical surfaces such as curbs, parapets, and vents.

3.07 BASE PLY FLASHING INSTALLATION

- A. Prior to application, the vertical surface receiving the base ply flashing shall receive a coat of primer at the rate of 150-200 sq. ft/gallon. This primer coating must be tacky before application of the base sheet flashing.
- B. Lay base ply flashing in strips three (3) feet wide to the vertical surfaces, extending onto the flat surface of the roof a minimum of four (4) inches. Side laps shall be three (3) inches and shall be staggered a minimum of four (4) inches with the laps of the base ply.
 - 1. ELIMINATE ALL VOIDS IN CORNERS AND AT LAPS.

3.08 FIELD TOP PLY INSTALLATION

- A. Once the base ply is applied and does not show any defects, install the FIELD cap ply.
- B. Unroll top ply starting from the low point of the roof. Care must be taken to insure good alignment of the first roll (parallel with the edge of the roof). A 45 degree angle cut shall be made on the selvage edge of underlying membrane prior to application. This is to insure a good seal at the membrane end laps and help eliminate "t" laps.
- C. Stagger base ply and top ply side seams a minimum of twelve (12) inches from one another. End laps should be staggered three (3) feet.
- D. Top ply shall have side laps of three (3) inches and end laps of six (6) inches.
- E. Roll the membrane into a full width application of cold adhesive. The membrane must be firmly and uniformly set, without voids, into the cold adhesive.
- F. Using a weighted roller, seal the membrane for proper adhesion.
- G. Application shall provide a smooth surface, free of air pockets, wrinkles, fishmouths or tears.
- H. Seal all laps by running a four (4) inch wide weighted roller over laps of the side seam.
- I. Run membrane tight up against any vertical surfaces such as curbs, parapets, and vents.
- J. After installation of the top ply, check all lap seams on the top ply using the edge of a hot trowel. Correct all defects.
- K. During installation, avoid cold adhesive seepage greater than 1/4 inch at seams.
 - 1. Cover cold adhesive seepage with a sprinkling of loose granules, color to match membrane. Apply granules at time of installation.

3.09 FLASHING TOP PLY INSTALLATION

- A. Lay top ply flashing in strips three (3) feet wide.
 - 1. Side laps shall be three (3) inches and shall be staggered a minimum of four (4) inches from top ply laps in order to avoid excessive thickness.

- B. Using a chalk line, lay-out a straight line on the surface of the top ply, parallel to the roof edge, six (6) inches inside the roof edge, or from the base of the cant strip or right angle to be flashed.
 - 1. Using a torch and heated flat trowel, embed the surface granules into the heated and soft bitumen from the chalk line to the edge of the top ply, and to the top of the cant or right angle.
- C. Heat weld top ply in accordance with recommendations of roofing manufacturer, onto the field base membrane ply a minimum of six (6) inches.
 - 1. During this application, simultaneously melt both surfaces forming an asphalt bead that pushes out in front of the top sheet.
- D. Do not burn the membrane and their respective reinforcements.
- E. Stagger base ply and top ply seams a minimum of twelve (12) inches.
- F. Ensure the two membranes are perfectly welded, without air pockets, wrinkles, fishmouths or tears.
- G. After installation of the top ply, check all lap seams on the top ply using the edge of a hot trowel. Correct any defect.
- H. During installation, avoid asphalt seepage greater than 1/4 inch at seams.

3.10 WALKWAY INSTALLATION

- A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.
 - 1. Set walkway pads in additional pour coat of hot roofing asphalt after aggregate surfacing of modified bituminous roofing membrane.
- B. Walkway Cap Sheet Strips: Install walkway cap sheet strips over roofing membrane using same application method as used for roofing membrane cap sheet.

3.11 WATER CUT-OFF

- A. At the end of the day's work, and when precipitation is eminent, a water cut-off shall be constructed at all open edges. Construct the cut-off with the same membrane and cold adhesive. Cut-off must be able to withstand extended periods of wet weather. The water cut-off shall be completely removed prior to resuming the installation of the roofing system.

3.12 CLEANING

- A. Clean-up and remove daily from the site all wrappings, empty containers, paper, loose particles and other debris resulting from these operations.
- B. Remove cold adhesive markings from finished surfaces.
- C. Repair or replace defaced or disfigured finishes caused by work of this section.

3.13 PROTECTION

- A. Provide traffic ways, erect barriers, fences, guards, rails, enclosures, chutes and the like to protect personnel, roofs and structures, vehicles and utilities.
- B. Plywood boards for traffic ways are required for any traffic movement over existing roofs. Plywood shall be not less than 5/8-inch thick.
- C. In addition to the plywood listed above, an underlayment of minimum 1/2-inch recover board is required on new roofing.
 - 1. Special permission must be obtained from the manufacturer before any traffic will be permitted over new roofing.

3.14 FIELD CONTROL

- A. Field inspection will be performed as outlined under 1.08 "Quality Assurance", of this section.

3.15 PITCH BOXES

- A. Install metal pitch box as per details assuring minimum 2-inch clearance around penetrations.

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1. Provide minimum 6-inch height above finished roofing.
2. Set primed flanges onto base ply assuring box rim is level and true.
- B. Seal by applying a reinforcing strip of base ply material that extends beyond the flange a minimum of 6-inches onto the roof.
 1. Seal all edges and seams.
- C. Top ply installed as specified in 3.08 of this Section.
- D. Fill box with lightweight grout filler to a minimum of 2-inches below the top edge of metal box. Seal boxes full to top with (1 or 2 part) pourable urethane sealer.
 1. Provide a sloped surface on sealer to the outside edge of the box on all sides.
 2. Optional - Provide a metal storm collar on all boxes.

3.16 ROOF DRAINS

- A. Provide a smooth transition from drain bowl to deck surface.
 1. Taper insulation back from drain a minimum of 24-inches to provide for positive drainage.
 2. Prime all surfaces of metal (drain base, leads and/or copper if used).
 3. Using a trowel, set a 6-inch wide layer of mastic around the drain bowl edge as water cut-off and seal on top of the drain base.
- B. Install base ply membrane with lap centered on drain bowl and as specified under 3.06 of this section ensuring a tight seal at drain base.
 1. Apply a reinforcing sheet of base ply membrane three feet square centered over drain.
 2. Carry all plies of membrane inside the edge of the drain bowl and temporarily secure all plies with the clamping ring. Cut a hole in membranes slightly larger in diameter than the down-pipe opening (should leave about 1" of membrane inside the clamping ring).
- C. Install top ply as specified in 3.08 of this section.
 1. Cut membrane opening 1" inside the edge of the drain bowl. Hole must be slightly larger than the down-pipe opening.
 2. Position membrane so as to be centered on the drain base and avoid the occurrence of any seams into drains. All other adjacent plies will shed 6" (min.) onto this ply.
 3. Seat drain clamping ring by heating it and firmly pressing it into place.
- D. Install clamping ring and drain covers supplied with drain.
- E. Test all drains for proper flow and watertightness. Correct defects.

3.17 VENT (STACK)

- A. Inspect base ply installation and ensure tight seal around pipe.
- B. Construct and install sheet metal vent sleeve as per details over base ply.
 1. Provide a minimum 5-inch base flange.
 2. Prime all metal surfaces.
- C. Apply a reinforcing sheet of base ply material three feet square over the vent.
 1. Seat all seams and edges with a trowel.
- D. Install top ply as specified in 3.08 of this section.
 1. Cut membrane to fit tight against stack sleeve and seal by running a heated trowel around vent base.
- E. Install metal vent cap.

3.18 EXPANSION JOINT

- A. Ensure all surfaces are soundly secured and fully primed prior to the installation of any membrane or flashing.
- B. Install base ply as specified in 3.06 of this section.
 1. Stop base ply membrane at juncture of horizontal to vertical surface.
- C. Install base flashing as detailed and in accordance with 3.07 of this section.

1. Flashing must extend a minimum of 4-inches onto the base ply and continue up the vertical surface onto the top edge of the expansion joint support and secure using roofing nails.
 2. Fill the expansion joint with compressible insulation supported by a layer of polyethylene film nailed off at top.
- D. Provide a continuous joint cover of mineral cushion as detailed.
1. Width of cushion to be three times that of the joint.
- E. Install pre-fabricated expansion joint cover by installing flanges onto expansion support and ensuing a minimum of 4-inch surface contact.
- F. Install top ply flashing as per 3.09 of this section.
1. Run flashing top of vertical surface of support and onto roof surface a minimum of 6-inches.
 2. Set all granules into membrane using a hot trowel where flashing overlap occurs.
 3. Install a slip sheet over joint as separation between joint cover and top ply.
- G. Cover the entire expansion joint with a single layer of top ply flashing as detailed and following specifications outlined in 3.09 of this section.

3.19 CORNER FLASHING

- A. Inside Corners:
1. Prime areas to receive flashings. Pre-cut all flashing pieces to fit areas to be flashed.
 2. Fabricate gussets 4-inch wide by 8-inch long with 2-inch triangular tips each end.
 - a. Install gussets into each corner using an electric heat gun and heated trowel.
 - b. Set preheated gussets tightly into corners with triangular tips folded inward. Using a heated trowel adhere gussets a minimum 2-inches on each side and fold tips by melting them with the heated trowel. (Self adhesive gussets are available as an alternate - check with your technical assistant).
 3. Pre-cut base flashing membranes to provide a 4-inch tie-in to roof surface and 3-inch return at corner.
 4. Apply first piece of base flashing membrane into corner to cover gusset. Pressing overlap and tie-in firmly into position with a trowel.
 5. Apply adjacent piece of base flashing sheet into position with edge tight into corner.
 - a. Base tie-ins on selvage must be cut at 45-degrees to eliminate voids at T-laps.
 - b. Seal all edges with a heated trowel.
 6. Pre-cut top flashing membranes to provide a 6-inch tie-in to roof surface and 3-inch return at corner.
- B. Outside Corners:
1. Pre-cut all flashing pieces and prime all surfaces prior to installation.
 2. Fabricate gusset 4-inch wide by 8-inch long with a 2-inch triangular tip.
 - a. Install gusset into corner using electric heat gun and firmly pressing with a trowel.
 - b. Set gusset with triangular tip on base ply and wrapping the corner a minimum of 2-inches on each side.
 3. Pre-cut base flashing membranes to provide a 4-inch tie-in to roof surface and 3-inch return at corner.
 4. Apply first base flashing sheet into corner over gusset pressing overlap and tie-in firmly into position with a hot trowel.
 5. Apply second base flashing sheet into position with returns wrapped around corners.
 - a. Cut off base tie-in selvage at 45-degree from vertical.
 - b. Seal all edges with a trowel.
 6. Pre-cut top flashing membranes to provide a 6-inch tie-in to roof surface and 3-inch return at corner.

3.20 CURBS

- A. Inspect and verify that all curbs are properly secured to deck, are level, a minimum of 6-inches above finished roof, primed and ready to receive flashings.
- B. Base ply membrane is to run horizontally tight up against the vertical curb or cant as required.
 - 1. When base ply membrane is to act as temporary seal for an extended length of time, carry membrane up vertical surface a minimum of 1-inch.
- C. Gusset to be fabricated 4-inch wide by 8-inch long with a 2-inch triangular tip.
 - 1. Install gusset onto corner using electric heat gun and firmly pressing with a hot trowel.
 - 2. Set gusset with triangular tip on base ply and wrapping the corner a minimum of 2-inches on each side.
- D. Install base ply flashing according to 3.07 of this section.
 - 1. Pre-cut flashing to the total sum of curb height, thickness plus 1-inch for inside curb securement and 4-inch tie-in along base with width to match that of curb plus 3-inch overlap on each end.
 - 2. Secure along inside of curb with roofing nails.
 - 3. Cut back corner base selvage at 45-degree angle from vertical.
- E. Install top ply as specified under 3.08 and 3.09 of this section.
 - 1. Pre-cut flashing to the total sum of curb height plus 6-inches for base tie-in with width to match that of curb plus 3-inch overlap at each end.
 - 2. Set granules with heated trowel on all surfaces to receive flashing.
 - 3. Cut flashing flush with the top of curb and seal edges with heated trowel.
 - 4. Cut back corner base selvage at 45-degree angle from vertical.
 - 5. Firmly press flashing into position using a damp sponge.
- F. Provide metal counter flashing.

3.21 ROOF EDGE

- A. Install base ply membrane as specified in 3.06 of this section. Carry membrane over roof edge (a minimum of 3-inches) and temporarily fasten to bottom most nailer using galvanized roofing nails.
- B. Install a continuous metal cleat (material) and metal edge as detailed.
 - 1. Prime all dissimilar surfaces prior to membrane or flashing installation.
 - 2. Minimum metal edge flange to be 4-inch and set into beads of mastic cement.
 - 3. Nail metal flange through base ply membrane to decking or wood blocking at 4-inch on center - staggered.
- C. Cover edge with a reinforcing strip of base membrane cold applied into place. Membrane is to carry beyond the metal flange onto base ply a minimum of 4-inches.
 - 1. Hold the reinforcing strip back from outside of metal edge by 3/4-inch.
 - 2. Seal all membrane edges with a heated trowel or electric heat gun.
- D. Install top ply of membrane according to 3.08 of this section with the edge tight against the metal and sealed with a hot trowel.

3.22 COPING/PARAPETS

- A. Verify all surfaces are properly secured and fully primed, ready to receive flashings.
- B. Base ply membrane is to run horizontally tight up to the vertical or cant as required.
- C. Install base ply flashing according to 3.07 of this section. Carry flashing up the vertical surface, over the top and down the outside face of the parapet a minimum of 3-inches. Fasten along outside edge at 4-inch centers using roofing nails.
 - 1. Install continuous metal cleats as detailed.
 - a. Prime all dissimilar surfaces prior to membrane or flashing installation.
 - b. Flashing on edge to be 4-inch minimum and set into full width of mastic.
 - c. Nail flanges to wood blocking at 4-inches on center - staggered.

2. Apply top membrane and flashing as detailed and specified under 3.08 and 3.09 of this section.

3.23 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field quality control and inspection.
- B. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work.

3.24 CLEANING

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Remove bituminous markings from finished surfaces.
- C. In areas where finished surfaces are soiled by bitumen or other source of soiling caused by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

3.25 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

**SECTION 07 6200
SHEET METAL FLASHING AND TRIM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and break metal, sill pans at storefront system, flashing at storefront system, trim on fascia and vertical wall above roof, and other items indicated.
- B. Sealants for joints within sheet metal fabrications.
- C. Reglets and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood nailers for sheet metal work.
- B. Section 07 7100 - Roof Specialties: Manufactured copings, flashings, and expansion joint covers.
- C. Section 07 7200 Roof Accessories: Manufactured metal roof curbs.
- D. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- C. ASTM B32 - Standard Specification for Solder Metal; 2020.
- D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- G. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2025.
- H. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- I. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2024).
- J. CDA A4050 - Copper in Architecture - Handbook; current edition.
- K. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples, ___ by ___ inches (___ by ___ mm) in size, illustrating metal finish color.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

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- B. Maintain one copy of each document on site.
- C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Pre-Finished Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 18 gauge, 0.040 inch (1.02 mm) thick; plain finish shop pre-coated with silicone modified polyester coating.
 - 1. Fluoropolymer Coating: High performance organic powder coating, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: As selected by Architect from manufacturer's full colors.
 - a. Provide custom color to match adjacent ACM metal panels where formed brake metal fascia and soffit are designated.
- B. Lead Sheet: ASTM B749, 0.047-inch (1.19 mm) minimum thickness; UNS Number L51121.
- C. Stainless Steel: ASTM A666/A666M, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch (0.40 mm) thick; smooth No. 4 - Brushed finish.

2.02 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Underlayment: Polyethylene, 6 mils (0.15 mm) thick.
- C. Primer: Zinc chromate type.
- D. Protective Backing Paint: Zinc molybdate alkyd.
- E. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
- F. Sealant to be Exposed in Completed Work: {rs\#1}; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.
- G. Plastic Cement: 1, Type I.
- H. Reglets: Surface mounted type, galvanized steel
- I. Solder: 1; Sn50 (50/50) type.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.
- G. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.04 SUPPER AND DOWNSPOUT FABRICATION

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- A. Downspouts, Gutters: SMACNA Architectural Sheet Metal Manual, Rectangular profile, unless otherwise indicated in Drawings.
- B. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).
- C. Accessories: Profiled to suit downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- D. Downspout Boots: Cast Aluminum, as specified in Section 05 5000.
- E. Seal metal joints.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.38 mm).

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Solder metal joints for full metal surface contact, and after soldering wash metal clean with neutralizing solution and rinse with water.
- E. Secure downspouts in place with concealed fasteners.
- F. Slope gutters 1/4 inch per 10 feet (2.1 mm per m), minimum.
- G. Connect downspouts to downspout boots, and grout connection watertight.

3.04 FIELD QUALITY CONTROL

- A. See Section for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

**SECTION 07 7100
ROOF SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured roof specialties, including copings, fascias, and gravel stops.
- B. Roof control and expansion joint covers.

1.02 RELATED REQUIREMENTS

- A. Section 07 5200 Modified Bitumen Membrane Roofing
- B. Section 07 7200 - Roof Accessories: Manufactured curbs, Roof Hatch.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.
- C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- D. NRCA (RM) - The NRCA Roofing Manual; 2024.
- E. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; 2011.

1.04 SUBMITTALS

- A. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- B. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- C. Samples: Submit two appropriately sized samples of coping and gravel stop.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Roof Edge Flashings and Copings:
 - 1. Architectural Products Co: www.archprod.com.
 - 2. W.P. Hickman Company; PermaSnap 2 Coping: www.wph.com.
- B. Control and Expansion Joint Covers:
 - 1. Construction Specialties, Inc; Roof Covers: www.c-sgroup.com/#sle.
 - 2. EMSEAL Joint Systems, Ltd; Emseal RoofJoint: www.emseal.com/#sle.
 - 3. _____.

2.02 COMPONENTS

- A. Roof Edge Flashings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
 - 1. Configuration: Fascia, cant, and edge securement for roof membrane.
 - 2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
- B. Copings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
 - 1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness, and finish as cap; concealed stainless steel fasteners.

2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
3. Material: Formed aluminum sheet, 0.040 inch (1.01 mm) thick, minimum.
4. Finish: 70 percent polyvinylidene fluoride.
5. Color: To be selected by Architect from manufacturer's full range.
6. Products:
 - a. W.P. Hickman Company; PermaSnap 2 Coping: www.wph.com.
- C. Control and Expansion Joint Covers: Composite construction of 8 inch (____ mm) wide flexible EPDM flashing of white color with closed cell urethane foam backing, each edge seamed to aluminum sheet metal flanges, designed for nominal joint width of 1 inch (25.4 mm). Include special formed corners, tees, intersections, and wall flashings, each sealed watertight.

2.03 FINISHES

- A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Seal joints within components when required by component manufacturer.
- C. Coordinate installation of components of this section with installation of roofing membrane and base flashings.
- D. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

SECTION 07 7200 ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured curbs.

1.02 RELATED REQUIREMENTS

- A. Section 05 3100 - Steel Decking.
- B. Section 07 52 00 - Modified Bituminous Membrane Roofing
- C. Section 07 6200 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.
- D. Section : Other manufactured roof specialty items.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- B. FM (AG) - FM Approval Guide; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Maintenance requirements.
- C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
- D. Warranty Documentation:
 - 1. Submit manufacturer warranty.
 - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

1.06 WARRANTY

- A. See Section for additional warranty requirements.
- B. Extended Correction Period: Correct defective work within 5-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 ROOF CURBS

- A. Roof Curbs Manufacturers:
 - 1. AES Industries Inc.: www.aescurb.com.
 - 2. The Pate Company: www.patecurbs.com.
 - 3. Roof Products & Systems (RPS); ____: www.rpscurbs.com/#sle.
 - 4. R&S Roof Products; www.rsroofproducts.com.
- B. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and

designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.

1. Roof Curb Mounting Substrate: Curb substrate consists of standing seam metal roof panel system.
2. Sheet Metal Material:
3. Galvanized Steel: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33 (230); G60 (Z180) coating designation; 18 gauge, 0.048 inch (1.21 mm) thick.
 - a. Finish: Factory primed.
 - b. Color: Color to match that of roof panel color selection.
4. Fabricate curb bottom and mounting flanges for installation directly on metal roof panel system to match slope and configuration of system.
 - a. Extend side flange to next adjacent roof panel seam and comply with seam configurations and seal connection, providing at least 6 inch (152 mm) clearance between curb and metal roof panel flange allowing water to properly flow past curb.
 - b. Where side of curb aligns with metal roof panel flange, attach fasteners on upper slope of flange to curb connection allowing water to flow past below fasteners, and seal connection.
 - c. Maintain at least 12 inch (305 mm) clearance from curb, and lap upper curb flange on underside of down sloping metal roof panel, and seal connection.
 - d. Lap lower curb flange overtop of down sloping metal roof panel and seal connection.
5. Provide layouts and configurations indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 1. Coat concealed side of uncoated aluminum and stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Roof Hatch Installation:
 - 1. Install roof hatch so top surface of hatch curb is level.
 - 2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 - 3. Attach ladder-assist post according to manufacturer's written instructions.
- E. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.04 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 9000 "Painting and Coating."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

3.05 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

SECTION 07 8400 FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- B. ITS (DIR) - Directory of Listed Products; Current Edition.
- C. FM (AG) - FM Approval Guide; Current Edition.
- D. FA (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.
- E. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).
- F. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures, for submittal process.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Installer's qualification statement.

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. 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.
- C. All materials shall be certified as totally asbestos-free.

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

1.07 PROJECT COORDINATION

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- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Manufacturers:
 - 1. A/D Fire Protection Systems Inc.: www.adfire.com.
 - 2. 3M Fire Protection Products: www.3m.com/firestop.
 - 3. Hilti, Inc: www.us.hilti.com/#sle.
 - 4. Specified Technologies, Inc.: www.stifirestop.com.
 - 5. Tremco, Inc.; Tremco Fire Protection Systems Group..
- B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.02 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist 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.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. Fire-resistance-rated walls include fire-barrier walls smoke-barrier walls and fire partitions.
 - 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- D. 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 manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.
 - a. Sleeve and rough opening sizes shall suit sizes of penetrating elements. Resultant annular spaces must not exceed governing UL design requirements nor manufacturer's criteria for material usage.

2.03 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

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- 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 elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- 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, non-shrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.04 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping 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

3.01 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. Field verify that net opening sizes and annular spaces do not exceed governing UL and manufacturer criteria. Reduce opening areas as necessary prior to firestopping installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping 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.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.

- B. Priming: 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.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.03 INSTALLATION

- A. General: Install penetration firestopping 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 fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 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.

3.04 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. 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 - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.05 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.06 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 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 is 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 and install new materials to produce systems complying with specified requirements.

3.07 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

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SECTION 07 9200 JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:
 - 1. Control and expansion joints in unit masonry.
 - 2. Joints in stonework set without mortar.
 - 3. Joints between different materials.
 - 4. Perimeter joints between materials listed above and frames of doors and windows.
 - 5. Control and expansion joints in ceiling and overhead surfaces.
 - 6. Other joints as indicated.
- B. Exterior joints in horizontal traffic surfaces as indicated below:
 - 1. Control, expansion, and isolation joints in cast-in-place concrete slabs.
- C. Interior joints in vertical surfaces and horizontal non-traffic surfaces as indicated below:
 - 1. Control and expansion joints on exposed interior surfaces of exterior walls.
 - 2. Perimeter joints of exterior openings where indicated.
 - 3. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - 4. Perimeter joints of toilet fixtures.
 - 5. Other joints as indicated.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping: Firestopping sealants.
- B. Section 08 7100 - Door Hardware: Setting exterior door thresholds in sealant.
- C. Section 08 8000 - Glazing: Glazing sealants and accessories.
- D. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- E. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
- C. Samples: For each type of 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.
- D. Preconstruction field test reports.
- E. Compatibility and adhesion test reports.

- F. Product certificates:
 - 1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant application similar in material, design and extent to that indicated for Project that have resulted in construction with a record of five (5) years successful in-service performance.
- B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.
- C. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to 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.
- D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 that is appropriate for the types of Project joints.
- E. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric 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.
- C. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.02 MATERIALS - 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 sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by manufacturer's full range.

2.03 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

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1. Additional Movement Capability: Where additional movement capability is specified in Elastomeric Joint Sealant Data Sheet, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrated indicated for Project.
- C. Suitability for Immersion in Liquids: Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- E. Type **ES-1**: Single-Component Neutral-Curing Silicone Sealant.
 1. Products:
 - a. Dow Corning Corporation; 795.
 - b. GE Silicones; UltraGlaze Silpruf.
 - c. Bostick Construction; Chem-Calk 1000
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25
 4. Uses Related to Exposure: NT (non-traffic).
 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
- F. Type **ES-2**: Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant.
 1. Products:
 - a. Pecora Corporation: 898.
 - b. Tremco: Tremsil 600 White.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25
 4. Uses Related to Exposure: NT (non-traffic).
 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
- G. Type **ES-3**: Multi-Component Nonsag Urethane Sealant.
 1. Available Products:
 - a. Sika AG, Sikaflex SL2
 - b. Pecora Corporation; Dynatrol II-SL
 2. Type and Grade: M (multi-component) and SL (self-leveling).
 3. Class: 25
 4. Uses Related to Exposure: T (traffic).
 5. Uses Related to Joint Substrates: M, G, A and, as applicable to joint substrates indicated, O.

2.04 LATEX JOINT SEALANTS

- A. Type **LS-1**: Latex Sealant: Comply with ASTM C 834, Type S, Grade NS. No silicone additives.
 1. Available Products:
 - a. Bostik Findley; PWC
 - b. Pecora Corporation; AC-20
 - c. Tremco; Tremflex 834.

2.05 JOINT-SEALANT BACKING

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- A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or any 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. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Type: 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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
- E. Backings shall be of a type recommended by sealant manufacturer. Diameter size shall be 25% larger than joint width.

2.06 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, 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: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.
 - a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, 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.
 - 2. Remove laitance and form-release agents from concrete.
 - a. Clean non-porous surfaces with chemical cleaners or other means that do not stain, harm, substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates, 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.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant 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.

3.03 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type 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. Size of backer rod to be 25% larger than joint width.
 - 2. Do not leave gaps between ends of sealant backings.
 - 3. Do not stretch, twist, puncture, or tear sealant backings.
 - 4. Remove absorbent sealant backings that have become wet before sealant applications and replace them with dry materials.
 - 5. Use single strand of material of proper diameter for respective joint width. Do not twist or braid multiple strands to create required diameters.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. 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 allows optimum sealant movement capability.
 - 4. Install caulks and sealants to fill joint without voids, achieve proper sealant depth and tool to create smooth surface.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below 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 sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint configurations per Figure 5A in ASTM C 1193, unless otherwise indicated.
- G. Installation of Preformed Silicone-Sealant System: Comply with manufacturer's written instructions.
- H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.
- I. 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.

3.04 JOINT SEALANT SCHEDULE

- A. Joint-Sealant Application **JS-1**: Exterior horizontal traffic isolation and contraction joints in cast-in-place concrete slabs.
 - 1. Joint Sealant: Multi-component pourable urethane sealant **ES-3**.
 - 2. Joint Sealant Color: Selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application **JS-2**: Exterior vertical control and expansion joints in unit masonry.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant **ES-1**.
 - 2. Joint Sealant Color: Selected by Architect from manufacturer's full range of colors.
- C. Joint Sealant Application **JS-3**: Exterior perimeter joints between metal wall panels and frames of doors, windows and louvers.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant **ES-1**.
- D. Joint Sealant Application **JS-4**: Exterior control and expansion joints in building.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant **ES-1**.
 - 2. Joint Sealant Color: Selected by Architect from manufacturer's full range of colors.
- E. Joint Sealant Application **JS-5**: Exterior joints in vertical and horizontal non-traffic surfaces at building.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant **ES-1**.
 - 2. Joint Sealant Color: Selected by Architect from manufacturer's full range of colors.
- F. Joint Sealant Application **JS-7**: Vertical control and expansion joints on exposed interior surfaces of exterior walls.
 - 1. Joint Sealant: Latex joint sealant **LS-1**.
 - 2. Joint Sealant Color: Selected by Architect from manufacturer's full range of colors.
- G. Joint Sealant Application **JS-8**: Interior perimeter joint of exterior openings.
 - 1. Joint Sealant: Latex joint sealant **LS-1**.
 - 2. Joint Sealant Color: Selected by Architect from manufacturer's full range of colors.
- H. Joint Sealant Application **JS-10**: Interior porcelain tile expansion, control, contraction, and isolation joints in horizontal traffic surfaces.
 - 1. Joint Sealant: Single-component mildew resistant neutral-curing silicone sealant **ES-2**.
 - 2. Joint Sealant Color: Selected by Architect from manufacturer's full range of colors.
- I. Joint Sealant Application **JS-11**: Interior joints between plumbing fixtures and adjoining walls, floors and counters.
 - 1. Joint Sealant: Single-component mildew resistant neutral-curing silicone sealant **ES-2**.
 - 2. Joint Sealant Color: Selected by Architect from manufacturer's full range of colors.
 - 3. Joint Sealant Color: White at all toilet fixture junctures.
 - 4. Joint Sealant Color: Clear at all kitchen equipment junctures.
- J. Joint Sealant Application **JS-12**: Vertical joints on exposed surfaces of interior unit masonry.
 - 1. Joint Sealant: Latex joint sealant **LS-1**.
 - 2. Joint Sealant Color: Selected by Architect from manufacturer's full range of colors.
- K. Joint Sealant Application **JS-13**: Vertical joints on exposed surfaces drywall partitions.
 - 1. Joint Sealant: Latex joint sealant **LS-1**.
 - 2. Joint Sealant Color: Selected by Architect from manufacturer's full range of colors.
- L. Joint Sealant Application **JS-15**: Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - 1. Joint Sealant: Latex Sealant **LS-1**.
 - 2. Joint Sealant Color: Selected by Architect from manufacturer's full range of colors.

**SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal frames for wood doors.
- D. Fire-rated hollow metal doors and frames.
- E. Thermally insulated hollow metal doors with frames.
- F. Accessories, including glazing.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Section 08 7100 - Door Hardware.
- C. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
- D. Section 09 9000 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- C. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2019.
- D. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.
- E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.
- H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- J. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- K. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- M. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2017.
- N. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- O. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
- P. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

1.07 WARRANTY

- A. Provide one year warranty from date of Substantial Completion against all defects in materials, workmanship and installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
 - 2. Republic Doors: www.republicdoor.com.
 - 3. Steelcraft: www.steelcraft.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 20 gauge, 0.032 inch (0.8 mm), minimum.
 - 2. Core Material: Polyurethane.

3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
 4. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
 5. Weatherstripping: Refer to Section 08 7100 Door Hardware.
 6. Door Finish: Factory primed and field finished.
- B. Interior Doors, Non-Fire Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 20 gauge, 0.032 inch (0.8 mm), minimum.
 2. Core Material: Kraftpaper honeycomb.
 3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
 4. Texture: Smooth faces.
 5. Door Finish: Factory primed and field finished.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. General:
1. Comply with the requirements of grade specified for corresponding door.
 - a. ANSI A250.8 Level 3 Doors: 14 gage frames. Exterior Frames
 - b. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 - SDI-100, Level 1, 18 gage, 0.042 inch (1.0 mm)
- C. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 2. Frame Finish: Factory primed and field finished.
 3. Weatherstripping: Separate, see Section 08 7100 Door Hardware.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
1. Frame Finish: Factory primed and field finished.
- E. Door Frames, Fire-Rated: Full profile/continuously welded type.
1. Fire Rating: Same as door, labeled.
 2. Frame Finish: Factory primed and field finished.
- F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- G. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches (102 mm) high to fill opening without cutting masonry units.

2.05 ACCESSORIES

- A. Glazing: As specified in Section 08 8000 Glazing, factory installed.
- B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches (102 mm) as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.06 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.

- C. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Install door hardware as specified in Section 08 7100 Door Hardware.
- F. Comply with glazing installation requirements of Section 08 8000 Glazing.
- G. Touch up damaged factory finishes.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

**SECTION 08 1416
FLUSH WOOD DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; fire rated and non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 08 1113 - Hollow Metal Doors and Frames.
- B. Section 08 7100 - Door Hardware.
- C. Section 08 8000 - Glazing.
- D. Section 09 2116 - Gypsum Board Assemblies:

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 4.0; 2021.
- C. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- D. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- E. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
 - 1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- D. Samples: Submit two samples of door construction, 6 by 6 inch (____ by ____ mm) in size cut from top corner of door.
- E. Samples: Submit two samples of door veneer, 6 by 6 inch (____ by ____ mm) in size illustrating wood grain, stain color, and sheen.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- G. Manufacturer's Installation Instructions: Indicate special installation instructions.
- H. Specimen warranty.
- I. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
 - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- C. Woodwork Quality Assurance Program:
 - 1. Provide labels indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.

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2. Provide designated labels on shop drawings as required by quality assurance program.
3. Provide designated labels on installed products as required by quality assurance program.
4. Submit documentation upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for 2 years.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 1. Graham Wood Doors: www.grahamdoors.com.
 2. ASSA Abloy Wood Doors: www.assaabloywooddoors.com.
 3. Eggers Industries: www.eggersindustries.com.
 4. Haley Brothers: www.haleybros.com.
 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS

- A. Doors: See drawings for locations and additional requirements.
 1. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
 1. Provide solid core doors at each location.
 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
 3. Wood veneer facing with factory transparent finish Maple, Plain Sawn, Custom Stained to match Architects sample.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Maple, veneer grade in accordance with quality standard indicated, plain sawn, with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
- B. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 1. Provide solid blocks at lock edge for hardware reinforcement.
 2. Provide solid blocking for other throughbolted hardware.
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

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- E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- G. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 3, Lacquer, Postcatalyzed. Two Coats
 - b. Stain: Match Architects Sample
 - c. Sheen: Match Architects sample.
- B. Factory finish doors in accordance with approved sample.
- C. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 08 1113.
- B. Glazing Stops in Non-Rated Doors: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- C. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Coordinate installation of doors with installation of frames and hardware.
- D. Coordinate installation of glazing.
- E. Install door louvers plumb and level.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

**SECTION 08 3100
ACCESS DOORS AND PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall and ceiling access door and frame units.

1.02 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

1.03 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Manufacturer's Installation Instructions: Indicate installation requirements.
- E. Project Record Documents: Record actual locations of each access unit.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

2.02 WALL AND CEILING MOUNTED UNITS

- A. Manufacturers:
 - 1. ACUDOR Products Inc: www.acudor.com/#sle.
 - 2. **Basis of Design:** Nystrom, Inc: www.nystrom.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
 - 1. Material: Steel.
 - 2. Door Style: Single thickness with rolled or turned in edges.
 - 3. Frames: 16 gage, 0.0598 inch (1.52 mm), minimum thickness.
 - 4. Single Steel Sheet Door Panels: 1/16 inch (1.6 mm), minimum thickness.
 - 5. Frames and flanges: 0.058 inch (1.5 mm) steel.
 - 6. Door panels: 0.070 inch (1.8 mm) single thickness steel sheet.
 - 7. Door panels: 0.070 inch (1.8 mm) double sheet with integral non-combustible insulation filler. Where indicated insulated.
 - 8. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
 - 9. Steel Finish: Primed.
 - 10. Primed and Factory Finish: Polyester powder coat; color to match adjacent wall or ceiling paint color, unless otherwise indicated..
 - 11. Size: As indicated, or required.
 - 12. Hardware:
 - a. Hardware for Fire-Rated Units: As required for listing.
 - b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
 - c. Hinge: Non-Fire-Rated Units: 175 degree steel hinges with removable pin.
 - d. Latch/Lock: Screw driver slot for quarter turn cam latch.
 - e. Gasketing: Extruded neoprene, around perimeter of door panel. Required where indicated on Drawings.
 - 13. Prime coat with alkyl primer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

**SECTION 08 4229
AUTOMATIC ENTRANCES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged power-operated door assemblies of following types:
 - 1. Sliding type.
- B. Automatic sliding doors, with frames.
- C. Controllers, actuators and safety devices.

1.02 RELATED REQUIREMENTS

- A. Section 26 2717- Equipment Wiring.
- B. Section 28 3100- Fire Detection and Alarm: Connection to fire alarm system.
- C. Section 08 8000 - Glazing: IG-8

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. BHMA A156.10 - American National Standard for Power Operated Pedestrian Doors; 2011.
- C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 101 - Life Safety Code; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Shop Drawings:
 - 1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.
 - 2. Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.
- C. Product Data: Provide data on system components, sizes, features, and finishes.
- D. Samples: Submit two samples of exposed to view hardware, carpet with frame, and attachment hardware.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.
- F. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- G. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.
- H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Wrenches and other tools required for maintenance of equipment.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience and approved by manufacturer.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty for motor and compressor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sliding Automatic Entrance Door Assemblies:
 - 1. ASSA ABLOY Entrance Solutions; Besam Resilience Full Impact (hurricane resistant): www.besam-usa.com.
 - 2. Horton Automatics: www.hortondoors.com.
 - 3. NABCO Entrances Inc; GT 1175 Whisper Slider: www.nabcoentrances.com/#sle.
 - 4. **Basis of Design:** Stanley Access Technologies; Dura-Storm 3000 BP, Impact Level D-Bi-Part: www.stanleyaccesstechnologies.com/sle.
 - 5. Or prior approved equal.

2.02 POWER OPERATED DOORS

- A. Power Operated Doors: Provide products that comply with NFPA 101 and requirements of authorities having jurisdiction; provide equipment selected for actual door weight and for light pedestrian traffic, unless otherwise indicated.
 - 1. Sliding and Folding Door Operators: In the event of power failure, provide for manual open, close, and break-away operation of door leaves.
 - 2. Packaged Door Assemblies: Provide components by single manufacturer, factory-assembled, including doors, frames, operators, actuators, and safeties.
 - a. Finish exposed equipment components to match door and frame finish.
- B. Sliding and Folding Doors with Full Power Operators: Comply with BHMA A156.10; safeties required; provide break-away operation unless otherwise indicated; in the event of break-away operation, interrupt power operation.

2.03 AUTOMATIC ENTRANCE DOOR ASSEMBLIES

- A. Comply with ADA Standards for egress requirements.
- B. Sliding Automatic Door: Bi-parting double leaf track-mounted, electric operation, extruded aluminum glazed door, with frame, and operator concealed overhead.
 - 1. Operation: Power open, power boost operation.
 - 2. Actuator(s): As indicated on drawings.
 - 3. Exterior-Side Actuator/Safety: Motion sensor.
 - 4. Interior-Side Actuator/Safety: Motion sensor.
 - 5. Hold Open: Toggle switch at inside head of doors; this is not a fire-rated door.
 - 6. Door and Frame Finish: Class 1 Anodized, natural.

2.04 DOOR OPERATORS

- A. Door Operators - General Requirements: Comply with BHMA A156.10, BHMA A156.19, and UL 325, as applicable.
 - 1. Select equipment to accommodate heavy pedestrian traffic and weight of doors.
 - 2. Provide equipment capable of operating, holding open, and closing doors under positive and negative wind pressures calculated in accordance with applicable code.
 - 3. Operating Temperature Range: Minus 20 to plus 140 degrees F (minus 7 to plus 60 degrees C) ambient.
 - 4. Provide operators that are fully adjustable for opening and closing speeds, checking speeds, and hold-open time.

5. Sliding Door Operators: Provide for manual open, close, and break-away operation of door leaves in the event of power failure. Maximum Force for Break-Away Function: 15 lbf (N).
6. Conform to applicable code for automatic release of control drive unit to permit manual opening of doors.
7. Finish exposed components to match door and door hardware finish.
8. Electric Operators: 1.5 hp (W) minimum, self-contained, chain driven, with release clutch.

2.05 ACTUATORS

- A. Proximity Detector Actuator/Safety: Microwave; distance of control sensitivity adjustable.
 1. Operation Zone: 60 inch (mm) long by 84 inch (mm) wide by 60 inch (mm) deep and 24 inch (mm) above floor.
 2. Safety Zone: Same dimensions as operating zone.

2.06 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Electrical Characteristics:
 1. 120 volts, single phase, 60 Hz.
- B. Motors: NEMA MG 1.
- C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
- D. Disconnect Switch: Factory mount disconnect switch in control panel.

2.07 ACCESSORIES

- A. Steel Clips, Supports, and Steel Anchors: Galvanized to 1.25 oz/sq ft (380 g/sq m).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.
 1. Verify that electric power is available and is of the correct characteristics.

3.02 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions.
 1. Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment.
 2. Provide for dimensional distortion of components during operation.
 3. Install pneumatic lines and door power units in a manner to prevent condensation or freezing.
 4. Coordinate installation of components with related and adjacent work; level and plumb.

3.03 ADJUSTING

- A. Adjust door equipment for correct function and smooth operation.

3.04 CLEANING

- A. Remove temporary protection, clean exposed surfaces.

3.05 CLOSEOUT ACTIVITIES

- A. Demonstrate operation, operating components, adjustment features, and lubrication requirements.

**SECTION 08 4230
INTERIOR AUTOMATIC ENTRANCES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged power-operated door assemblies of following types:
 - 1. Sliding type.
- B. Automatic sliding doors, with frames.
- C. Controllers, actuators and safety devices.

1.02 RELATED REQUIREMENTS

- A. Section 26 0583 - Wiring Connections.
- B. Section 28 4600 - Fire Detection and Alarm: Connection to fire alarm system.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. BHMA A156.10 - Power Operated Pedestrian Doors; 2017.
- C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 DEFINITIONS

- A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to activate the operation of the door.
 - 1. Knowing act: Consciously initiating the opening of a power operated door using acceptable methods including wall mounted switches such as push plates and controlled access devices such as keypads, card readers and key switches.
- B. Safety Device: A device that detects the presence of an object or person within a zone where contact could occur and provides a signal to stop the movement of the door.

1.05 PERFORMANCE REQUIREMENTS

- A. Compliance with the following:
 - 1. ANSI/BHMA A156.10 American National Standard for Power Operated Pedestrian Doors.
 - 2. UL 325 listed.
- B. Automatic door equipment accommodates medium to heavy pedestrian traffic.
- C. Entrapment Force Requirements:
 - 1. Power Operated Sliding Doors: Not more than 30 lbf (133 N) required to prevent stopped door from closing.
 - 2. Sliding doors provided with a breakaway device shall require no more than 50 lbf (222N) applied 1 inch (25 mm) from the leading edge of the lock stile for the breakout panel to open.

1.06 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Shop Drawings:
 - 1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.
 - 2. Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.

- C. Product Data: Provide data on system components, sizes, features, and finishes.
- D. Samples: Submit two samples of exposed to view hardware, carpet with frame, and attachment hardware.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.
- F. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- G. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.
- H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Wrenches and other tools required for maintenance of equipment.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience, and a member of AAADM.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
 - 1. Certified by AAADM.
- C. Certified Inspector Qualifications: Certified by AAADM.
- D. Source Limitations for Automatic Entrances: Obtain each type of door, frame, operator and sensor components specified in this Section from a single source, same manufacturer unless otherwise indicated.
- E. Power-Operated Pedestrian Door Standard: ANSI/BHMA A156.10 (current version).
- F. Emergency Exit door requirements: Comply with requirements of authorities having jurisdiction for automatic entrance doors serving as a required means of egress

1.08 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings to receive automatic entrances by field measurements before fabrication and indicate on shop drawings

1.09 COORDINATION

- A. Coordinate sizes and locations of recesses in concrete floors for recessed tracks and thresholds if applicable. Concrete work is specified in Division 03.
- B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies and access control system as applicable

1.10 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.
- C. Provide one year manufacturer warranty for motor and compressor.
- D. During the warranty period a factory trained technician shall perform and affect repairs. An inspection shall be performed after each adjustment or repair. All warranty work, including but not limited to emergency service, shall be performed during normal business hours. Manufacturer shall have in place and dispatch procedure that shall be available 24 hours a day, 7 days a week for emergency call back service.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sliding Automatic Entrance Door Assemblies: Sliding automatic entrance system including sliding panels, sidelites, aluminum frame, overhead concealed, electro-mechanical operator, operator housing, guide system and carrier assemblies, controls and accessories as required for a complete installation.
 - 1. ASSA ABLOY Entrance Solutions; Besam SL500 CGL: www.besam-usa.com.
 - 2. Horton Automatics: www.hortondoors.com.
 - 3. NABCO Entrances Inc: www.nabcoentrances.com/#sle.
 - 4. **Basis of Design:** Stanley Access Technologies; Dura-Storm 2000 SS: www.stanleyaccesstechnologies.com/sle.
 - 5. Or prior approved equal.

2.02 POWER OPERATED DOORS

- A. Power Operated Doors: Provide products that comply with NFPA 101 and requirements of authorities having jurisdiction; provide equipment selected for actual door weight and for light pedestrian traffic, unless otherwise indicated.
 - 1. Sliding and Folding Door Operators: In the event of power failure, provide for manual open, close, and break-away operation of door leaves.
 - 2. Packaged Door Assemblies: Provide components by single manufacturer, factory-assembled, including doors, frames, operators, actuators, and safeties.
 - a. Finish exposed equipment components to match door and frame finish.
- B. Sliding with Full Power Operators: Comply with BHMA A156.10; safeties required; provide break-away operation unless otherwise indicated; in the event of break-away operation, interrupt power operation.

2.03 AUTOMATIC ENTRANCE DOOR ASSEMBLIES

- A. Comply with ADA Standards for egress requirements.
- B. Sliding Automatic Door: Single leaf track-mounted, electric operation, extruded aluminum glazed door, with frame, and operator concealed overhead.
 - 1. Traffic: 2 way
 - 2. Emergency Breakaway Capacity: Sliding leaves only.
 - 3. Mounting:
 - 4. Overhead header installed between jambs.
 - 5. Operation: Power open, power boost operation.
 - 6. Actuator(s): As indicated on drawings.
 - 7. Exterior-Side Actuator/Safety: Motion sensor.
 - 8. Interior-Side Actuator/Safety: Motion sensor.
 - 9. Hold Open: Toggle switch at inside head of doors; this is not a fire-rated door.
 - 10. Material: Extruded Aluminum Alloy 6063-T5.
 - 11. Horizontal door rails shall have a minimum 0.125 inch (3.2mm) structural wall thickness.
 - 12. Top rail height shall be 5 1/2 inches (140mm)
 - 13. Bottom rails shall be 10 inch.
 - 14. Door and Frame Finish: Anodized, natural, to match adjacent storefront system.
 - 15. Weather stripping shall be provided by means of replaceable heavy pile mohair unless otherwise indicated. The following types of weather-stripping are required: slide-in type pile weather-stripping retained by UV stabilized polycarbonate extrusions on the leading edge of sliding door panels and back edge of sidelites, neoprene weather-stripping on the butt edge of sliding and lead edge of sidelite panels, to be retained by UV stabilized polycarbonate extrusion and overlap opposing seals in the closed door position.
 - 16. Glass: Glazing shall comply with ANSI Z97.1, 1/2" thickness, tempered at active door and sidelite panels and transom panel.
- C. Door Carriers:
 - 1. Carriage Assembly: Carriage bar with two wheel assemblies. Each assembly shall have tandem roller wheels.

2. Roller Wheels: Two heavy duty Delrin roller wheels per wheel assembly, for a total of four (4) roller wheels, 1-7/16 inch (36.51 mm) diameter, per active door leaf for operation over a replaceable aluminum track. Single journal with sealed oil impregnated bearings.
 3. Two (2) heavy duty self-aligning anti-risers per leaf.
- D. Framing Members: Provide automatic entrances as complete assemblies. Manufacturer's standard extruded aluminum framing reinforced as required to support loads.
1. Vertical Jambs: 1-3/4 inches (44.5 mm) by 4-1/2 inches (114.3 mm).
- E. Header: Manufacturer's standard extruded aluminum header with a replaceable aluminum track extending full width of entrance unit. Header to conceal door operators, carrier assemblies, and roller track; complete with hinged access panel for service of door operator, and controls.
1. Header Span: Maximum 16'-0" (4.9 m) without intermediate supports when entrance glazed with 1/2-inch (12.7 mm) glass.
 - a. Capacity: Capable of supporting active breakout leafs up to maximum of 220 lb (100 kg) per leaf when header is supported per manufacturer's recommendations
 2. Header Size: 4-1/2 inches (114.3 mm) wide by 7 inches (177.8 mm) high.
 3. Header height including the sensor plate cap which spans the clear door opening width is 8 inches (203.2 mm) high.
 4. Header Access: Continuous hinge at top of header allows cover to swing and allow complete access to operator and internal electronic and mechanical assemblies.
 5. Design: Closed header when doors in closed position

2.04 HARDWARE

- A. Hardware: Provide manufacturer's standard hardware as required for operation indicated.
1. Breakaway arms and bottom pivot assemblies shall be supplied by the manufacturer and shall be adjustable to comply with applicable codes.
 2. Magnetic catch(s) to retain breakout door and sidelite panels in the closed position.
 3. Locking hardware shall be provided as indicated.
 - a. Electrified slide lock shall automatically lock the sliding function of all sliding door panels within the entrance when the door panels are in the closed position.
 - 1) Fail secure operation: Slide lock shall lock the sliding function of the door panels upon loss of power.
 - 2) Exterior jamb mounted key switch to unlock sliding door operation.
 - b. Deadbolts, one per leaf.
 - 1) Mounting Location: Extend bolt from bottom rail of sliding panel into floor.
 - 2) Interior Side: No operation.
 - 3) Exterior Side: Keyed cylinder.
 - 4) Provide dust proof floor strike.
 4. Keyed cylinders shall be provided as indicated.
 - a. Manufacturer's standard keyed cylinder.
 - b. Keyed cylinder specified in Division 8 Section "Door Hardware".
 - c. Keyed cylinder by others.
- B. Guide Track/Threshold: Manufacturer's threshold as indicated.
1. Fixed Sidelite Entrance Guide Track: Aluminum guide track integrated in the bottom of the sidelite portion of the sliding automatic door assembly.

2.05 DOOR OPERATORS

- A. Door Operator and Controller:
1. Electro-mechanical controlled unit utilizing a high-efficiency, energy efficient, DC motor requiring a maximum of 3 amp current draw, allowing 5 operators on one 20 amp circuit. The supplied system shall have the capability to operate at full performance well beyond a brown out and high line voltage conditions (85V - 265V) sensing changes and adjusting

automatically. The operator shall allow an adjustable hold open time delay of 0 to 60 seconds and have internal software to incorporate a self-diagnostic system.

2. Operating Temperature Range: -31° F to 130° F (-35° C to 54.44° C).

B. Microprocessor Control Box:

1. Modular control unit to allow for changing technology. Factory-adjusted configuration with opening and closing speeds set to comply with ANSI/BHMA A156.10 requirements and electronic dampening to reduce wear on drive train. Should the drive train operations deviate from design criteria ranges, Watchdog Control Circuit Monitoring will assume command of the system and shut down the automatic function allowing a secondary supervisory circuit to perform as a backup. Control unit shall allow the following functions:
 - a. Diagnostics with the ability to produce application data.
2. Mode Selector Control:
 - a. Multi-position rotary knob mode selector control shall allow selection of the indicated functions to be engaged when switch is turned to the appropriate setting.
 - b. Mode Selector Control Mounting: Control shall be mounted as indicated:
 - 1) Jamb mounted.
 - c. Mode selector control to allow the following functions:
 - 1) "Off"
 - 2) "Exit Only" one way traffic with automatic operation from the interior.
 - 3) "Two Way Traffic" allowing automatic operation from exterior and interior.
 - 4) "Partial Opening" energy saving door position allows door to automatically adjust opening width based on amount of usage, that is, full open during high use and partial open during low use. The control for this setting is programmable allowing adjustment to both the usage setting and the opening width
 - 5) "Hold Open" doors activated and held in the full open position.

2.06 ACTIVATION AND SAFETY CONTROL DEVICES

- A. General: Provide the types of activation and safety devices specified in accordance with ANSI/BHMA standards, for the condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.
- B. Combination Activation Motion Sensor/Safety Presence Sensor:
 1. Shall be a sliding door sensor utilizing K-band microwave technology to detect motion and focused active infrared technology to detect presence, combined in a single housing surface mounted on each side of the header.
 - a. Presence sensor shall remain active at all times.
 - b. The sensor shall communicate with the automatic door operator through a self-monitoring connection that allows the door to go into a fail-safe mode preventing the door from closing in the event of a sensor failure.
 2. Motion/presence detecting sensors to be field installed and adjusted

2.07 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Electrical Characteristics:
 1. 120 volts, single phase, 60 Hz.
- B. High-Efficiency DC Motor: Maximum of 3 amp current draw, allowing 5 operators to run on one 20 Amp circuit.
- C. Power: Self-detecting line voltage capable control. 120 VAC through 240 VAC, 50/60 Hz, 3 amp minimum incoming power with solid earth ground connection for each door system.
- D. Key Impulse Input: Input for card readers or remote activation with independent adjustable hold open delay.
- E. Wiring: Separate internal channel raceway free from moving parts.

- F. Brown out / high voltage capability: System has capability to operate at full performance well beyond brown out and high voltage line conditions (85 V - 265 V) sensing changes and adjusting automatically.
- G. Convenience Battery: Shall be concealed in header and capable of full operation with blackout conditions, including sensor capabilities for minimum of 100 cycles.
- H. Digital Cycle Counter: Battery powered, 7 digit LCD cycle counter with a reset feature to track door usage cycles.
- I. Motors: NEMA MG 1.
- J. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
- K. Disconnect Switch: Factory mount disconnect switch in control panel.

2.08 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Anodized Finish:
 - 1. AAMA 611, Clear, AA- M12C22A41, Class I, 0.018 mm.

2.09 ACCESSORIES

- A. Steel Clips, Supports , and Steel Anchors: Galvanized to 1.25 oz/sq ft (380 g/sq m).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available and is of the correct characteristics.

3.02 INSTALLATION

- A. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Install surface mounted hardware using concealed fasteners to greatest extent possible.
 - 2. Set headers, carrier assemblies, tracks, operating brackets and guides level and true to location with anchorage for permanent support.
- D. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections.
- E. Glazing: Glaze sliding automatic entrance door panels in accordance with the Glass Association of North America (GANA) Glazing Manual, published recommendations of glass product manufacturer, and published instructions of automatic entrance system manufacturer.
- F. Sealants: Comply with requirements specified in division 7 Section "Joint Sealants" to provide a weather tight installation.
 - 1. Set thresholds, bottom guide and track systems and framing members in full bed of sealant.
 - 2. Seal perimeter of framing members with sealant.
- G. Signage: Apply signage on both sides of each door and sidelite as required by ANSI/BHMA A156.10 and manufacturers installation instructions.
- H. Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment.

- I. Provide for dimensional distortion of components during operation.
- J. Install pneumatic lines and door power units in a manner to prevent condensation or freezing.
- K. Coordinate installation of components with related and adjacent work; level and plumb.

3.03 ADJUSTING

- A. Adjust door equipment for correct function and smooth operation.
- B. Adjust door operators, controls and hardware for smooth and safe operation and for weather tight closure. Adjust doors in compliance with ANSI/BHMA A156.10.
- C. Verify installation and alignment of all entrance weather-stripping as required for compliance with specified air infiltration requirements

3.04 CLEANING

- A. Remove temporary protection.
- B. Clean adjacent surfaces soiled by door installation.
- C. Clean glass and metal surfaces promptly after installation. Remove excess sealants, compounds, dirt and other substances. Repair damages to match original finish

3.05 CLOSEOUT ACTIVITIES

- A. Before placing doors into operation, AAADM certified technician shall inspect and approve doors for compliance with ANSI/BHMA A156.10. Certified technician shall be approved by the manufacturer.
- B. Demonstrate operation, operating components, adjustment features, and lubrication requirements.

SECTION 08 4313
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed exterior storefront, with vision glass.
- B. Aluminum-framed Interior storefront, with vision glass
- C. Aluminum doors and frames.
- D. Storefront Door Hardware.
- E. Perimeter sealant.
- F. Weatherstripping.

1.02 RELATED REQUIREMENTS

- A. Section 05 1200 - Structural Steel Framing: Steel attachment members.
- B. Section 07 1300 - Self-Adhered Sheet Membrane: Perimeter air and vapor barrier seal between glazing system and adjacent construction.
- C. Section 07 8400 - Firestopping: Firestop at system junction with structure.
- D. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- E. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- F. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.
- B. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.
- C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- D. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).
- I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).
- J. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).
- K. FLA (PAD) - Florida Building Code Online - Product Approval Directory; Current Edition.
- L. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

- M. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.
- N. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- O. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- P. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- Q. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- R. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- S. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- T. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- U. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).
- V. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.
- W. FLA (PAD) - Florida Building Code Online - Product Approval Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures, for submittal of items required.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details .
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- F. Samples: Submit two samples 12 x 12 inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.
- G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion.
- B. Provide two year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- C. Provide two year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 FRAMING FOR INSULATING GLAZING

- A. Center-Set Style, Wind-Borne-Debris Resistance Tested, Thermally-Broken:
 - 1. Basis of Design: Kawneer North America
 - 2. Oldcastle Building Envelope
 - 3. YKK AP America Inc;
 - 4. C.R. Laurence Company, Inc; U.S. Aluminum
 - 5. Or approved equal.

2.02 EXTERIOR STOREFRONT BASIS OF DESIGN

- A. Aluminum-Framed Storefront: Kawneer IR 521/521T/521UT fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. System Dimensions: 2-3/4" x 5".
 - 2. Finish: Kynar PVDF resin based finish, color to be selected by the Architect from the manufacturer's full color range.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
 - c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
 - 1) Provide flush joints and corners, weather sealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads, receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.

2.03 SWINGING DOORS - BASIS OF DESIGN

- A. Wind-Borne-Debris Resistance Tested:
 - 1. Kawneer North America. 350/500 (Heavy Wall IR Entrances) for entrances in exterior storefront and curtainwall.
- B. Interior Storefront:

1. Kawneer North America 500 for entrances in interior storefront
- C. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 1. Trulite Glass & Aluminum Solutions, LLC;
 2. YKK AP America Inc;
 3. C.R. Laurence Company, Inc; U.S. Aluminum;
- D. Substitutions: See Section 01 6000 - Product Requirements.
 1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.04 STOREFRONT

- A. Exterior Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 1. Glazing Position: Center-set.
 2. Vertical Mullion Dimensions: 2 3/4 inches wide by inches deep;
 3. Finish: Kynar PVDF resin based finish, color to be selected by the Architect from the manufacturer's full color range.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 6. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Structural Performance Requirements:
 1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 2. Design Wind Loads: See Structural Design Loads.
 - a. Measure performance by testing in accordance with ASTM E330/E330M, using test loads equal to 1.5 times the design wind loads and 10 second duration of maximum pressure.
 - b. Member Deflection: For spans less than 13 feet 6 inches, limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span or 3/4 inch, whichever is less and with full recovery of glazing materials.
 - c. Member Deflection: For spans over 13 feet 6 inches and less than 40 feet, limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 1/4 inch, with full recovery of glazing materials.
 3. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
 4. Air Leakage Laboratory Test: Maximum of 0.06 cu ft /min / sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
 - a. Windborne-Debris Impact Resistance: Passes Provide ASTM E1886 missile-impact and cyclic-pressure tests according ASTM E1996 for Wind Zone 3 (New Orleans) basic protection.
 - 1) Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
 - 2) Small-Missile Test: For glazing located between 30 feet (9.1 m) and 60 feet (18.3 m)
 5. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.

6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 8. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
 9. Air Leakage Laboratory Test: Maximum of 0.06 cu ft /min / sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
 10. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 11. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 12. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
- C. Interior Aluminum Framed Storefront: Factory fabricated, factory finished Aluminum framing members with infill, anchorage, and attachment devices.
1. Basis of Design: Kawneer Trifab 400.
 2. Glazing Position: Center
 3. Vertical mullion Dimensions: 1-3/4" x 4"
 4. Finish: Kynar PVDF resin based finish, color to be selected by the Architect from the manufacturer's full color range.

2.05 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
- B. Glazing: As specified in Section 08 8000.
- C. Doors: Glazed aluminum. Wide Stile Doors with 1" insulated glass.
1. Thickness: 2 inches.
 2. Top Rail: 5 inches wide.
 3. Vertical Stiles: 5 inches wide.
 4. Bottom Rail: 10 inches wide.
 5. Glazing Stops: Square.
 6. Finish: Same as storefront.

2.06 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Perimeter Sealant: Type as specified in Section 07 9200.
- D. Glass: As specified in Section 08 8000.
- E. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- F. Glazing Accessories: As specified in Section 08 8000.

2.07 HARDWARE

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: Manufacturer's full range, meeting specified wind rating for exterior doors. Provide all necessary hardware as needed to provide complete functional and locking system unless hardware component is otherwise specified in Section 08 7100.
- C. Weatherstripping: neoprene, continuous and replaceable; provide on all doors.
- D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
- E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.
- F. Hinges: Butt type, swing clear; top and bottom.
 - 1. Butt type, swing clear; top and bottom. Provide on doors as indicated.
 - 2. Continuous hinges at exterior doors.
- G. Push/Pull Set: Standard configuration push/pull handles. Pull and thumb trim at primary doors. Dummy trim with no pull at secondary exterior doors.
- H. Exit Devices: Panic-Listed Rim Exit Device. No exposed vertical rods. Hex key dogging.
- I. Door Closers: Concealed overhead. Regular Arm Mounting at Exterior, Dining and Gymnasium doors.
- J. Handle Latch: Manufacturer's full range.
- K. Cylinders

2.08 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- E. Arrange fasteners and attachments to conceal from view.
- F. Reinforce components internally for door hardware.
- G. Reinforce framing members for imposed loads.
- H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
 - 1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.

- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Set thresholds in bed of sealant and secure.
- K. Install glass and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.
- L. Install perimeter sealant in accordance with Section 07 9200.
- M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- B. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
 - 1. Perform a minimum of two tests in each designated area as indicated on drawings.
 - 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
 - 3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf (200 Pa).
 - a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce (14 gram) that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.
- C. Repair or replace storefront components that have failed designated field testing, and retest to verify performance conforms to specified requirements.

3.05 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
- C. Remove excess sealant by method acceptable to sealant manufacturer.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

SECTION 08 4413
GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed curtain wall systems, with vision glazing and glass infill panels, including perimeter trims, stools, accessories, shims, and anchors, and perimeter sealing of curtain wall framing.
- B. Firestopping between curtain wall and edge of floor slab.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Weld plates embedded in concrete for attachment of anchors.
- B. Section 03 4500 - Precast Architectural Concrete: Weld plates embedded in precast concrete for attachment of anchors.
- C. Section 05 1200 - Structural Steel Framing: Steel attachment members.
- D. Section 07 8400 - Firestopping: Firestop at system junction with structure.
- E. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- F. Section 08 4230 - Interior Automatic Entrances.
- G. Section 08 4243 - Intensive Care Unit/Critical Care Unit Entrances:
- H. Section 08 4313 - Aluminum-Framed Entrances and Storefronts: Entrance framing and doors.
- I. Section 08 8000 - Glazing.
- J. Section 12 2400 - Window Shades: Attachments to framing members.
- K. Section 11 2423.13 - Window Washing Systems: Window washing equipment requirements.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- C. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- G. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
- H. ASTM C793 - Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants; 2023.
- I. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
- J. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- K. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

- L. ASTM C1135 - Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants; 2019 (Reapproved 2024).
- M. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2023.
- N. ASTM C1249 - Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications; 2018 (Reapproved 2023).
- O. ASTM C1401 - Standard Guide for Structural Sealant Glazing; 2023.
- P. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).
- Q. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
- D. Shop Drawings: Provide details of proposed structural sealant glazing (SSG) and weather sealant joints indicating dimensions, materials, bite, thicknesses, profile, and support framing.
- E. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.
- F. Report of field testing for water leakage.
- G. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.
- H. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- I. Samples: Submit two samples 12 by 12 inches (by mm) in size illustrating finished aluminum surface, glazing, infill panels, and glazing materials.
- J. Structural Sealant Glazing (SSG): Submit product data and calculations showing compliance with performance requirements.
- K. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the State in which the Project is located.
- B. Verify that each component is appropriate for use in structural sealant glazing (SSG) application in regards to at least the following properties; size, shape, dimensions, material, self-life, storage conditions, and color.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than five years of documented experience.

- D. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

1.07 MOCK-UP

- A. See Section 01 4000 - Quality Requirements, for general requirements for mock-ups.
- B. Provide 8 by 8 feet (____by____ mm) mock-up including each component being used on the project. Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.
- C. Locate on-site where directed by Architect; mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees Fahrenheit (4.44 degrees Celsius). Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

- A. See Section 017700 - Closeout Procedures, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.
- C. Provide two year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide two year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Kawneer North America; Product types indicated in the schedule below.
 - 1. Type 1: Kawneer 1600 System 1 (SS), 2-1/2" x 7-1/2", outside glazed with vertical SSG and horizontal pressure plate.
 - 2. Type 2: Kawneer Clearwall Curtain Wall System (SS): 2-1/2" x 6-5/8", outside glazed with recessed glass edge spacer. Horizontal SSG with 7 1/2" Vertical Mullion Extenders.
- B. Glazed Aluminum Curtain Walls:
 - 1. EFCO, a Pella Company: www.efcocorp.com/sle.
 - 2. Oldcastle Building Envelope: www.oldcastlebe.com.
 - 3. YKK AP America Inc: www.ykkap.com.
 - 4. Or approved equal.

2.02 CURTAIN WALL

- A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Structural sealant glazing (SSG) adhesive on two (2)-sides, with temporary glazing stops, and pressure plate and mullion cover on 2-sides, where indicated on drawings.
 - 2. Structural sealant glazing (SSG) adhesive on four (4)-sides, with temporary glazing stops, where indicated on drawings.
 - 3. Fabrication Method: Shop/factory unitized system.
 - 4. Glazing Method: Either shop/factory or field glazed system.
 - 5. Vertical Mullion Dimensions: 2-1/2 inches (64 mm) wide by 7-1/2 inches (190 mm) deep, and 2-1/2 inches (64 mm) wide by 6-5/8 inches (168 mm) deep - as indicated in schedule above and on Drawings.

6. Vertical Mullion Cover Extenders: 7" deep, or as indicated on Drawings. Width to match curtain wall system.
 7. Finish: Class I natural anodized.
 - a. Factory finish surfaces that will be exposed in completed assemblies.
 - b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
 8. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 9. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 10. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
1. Design Wind Loads: Comply with the applicable code.
 - a. Member Deflection: For spans less than 13 feet (396.24 cm) 6 inches (152.4 mm), limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span or 3/4 inch (19.05 mm), whichever is less and with full recovery of glazing materials.
 - b. Member Deflection: For spans over 13 feet (396.24 cm) 6 inches (152.4 mm) and less than 40 feet (1219.2 cm), limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 1/4 inch (6.35 mm), with full recovery of glazing materials.
 2. Wind-Borne-Debris Resistance: Identical full-size glazed assembly without auxiliary protection tested by independent agency in accordance with ASTM E1996 for Wind Zone 4 - Additional Protection for Large and Small Missile impact and pressure cycling at design wind pressure.
 3. Movement: Accommodate the following movement without damage to components or deterioration of seals:
 - a. Expansion and contraction caused by 180 degrees Fahrenheit (82.22 degrees Celsius) surface temperature.
 - b. Expansion and contraction caused by cycling temperature range of 170 degrees Fahrenheit (76.67 degrees Celsius) over a 12 hour period.
 - c. Movement of curtain wall relative to perimeter framing.
 - d. Deflection of structural support framing, under permanent and dynamic loads.
 4. Structural Sealant Glazing (SSG) System: For individual glass lites, design framing members to not exceed a deflection normal to the wall of L/175 between supports with 3/4 inch (19.05 mm) maximum, and a deflection parallel to the wall of L/360 with 1/8 inch (3.18 mm) maximum, whichever is less.
- C. Water Penetration Resistance: No uncontrolled water on indoor face when tested as follows:
1. Test Pressure Differential: 10 psf (480 Pa).
 2. Test Method: ASTM E331.
 3. Test Pressure Differential: 12 lbf/sq ft (Pa).
- D. Air Leakage: Maximum of 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 psf (300 Pa) pressure differential across assembly.
- E. Air Infiltration Performance Requirements:
1. Limit air infiltration through assembly to 0.06 cu ft/min/sq ft (0.3 L/s/sq m) of wall area or less, measured in accordance with ASTM E283.
 2. Air Infiltration Test Pressure Differential: 6.24 pounds per square inch.

2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 - 1. Framing members for interior applications need not be thermally broken.
 - 2. Cross-Section: As indicated on drawings.
 - 3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
- B. Glazing: As specified in Section 08 8000.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
 - 1. Additional spacers required to be provided and installed by manufacturer:
 - a. provide one 1/2" x 1/2" U channel screwed down as close to the exterior 1" insulated glass as possible. Leave a space of 3/8" for the stained glass, then another 1/2" x 1/2" U channel stop for the interior of the stained glass. Spacer between the insulated glass should be dark bronze or black - non reflective.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.
- C. Firestopping: As specified in Section 07 8400.
- D. Structural Sealant Glazing (SSG) Adhesive: Neutral curing, silicone sealant formulated for SSG applications in compliance with ASTM C1184 and structural glazing industry guidelines, ASTM C1401.
 - 1. SSG adhesive in compliance with ASTM C920; Type S - Single-component, Grade NS, Class 50, Use NT, G, and A.
 - 2. Ultimate Tensile Strength: Minimum of 50 psi (344.74 kPa) as determined by test method ASTM C1135 under the following conditions.
 - a. Exposure to air temperatures of 190 degrees Fahrenheit (87.78 degrees Celsius) and minus 20 degrees Fahrenheit (-6.67 degrees Celsius).
 - b. Water immersion for seven (7) days, minimum.
 - c. Exposure to weathering for 5,000 hours, minimum.
 - 3. Sealant Design Tensile Strength: 20 psi (137.90 kPa), maximum.
 - 4. Hardness: 20 to 60 with Type A-2 durometer in compliance with test method ASTM C661.
 - 5. Color: As selected by Architect from manufacturer's full range.
 - 6. SSG sealant tested for compatibility with glazing accessories in compliance with ASTM C1087, tested for accelerated weathering in compliance with ASTM C793, and in compliance with insulating glass secondary sealant design standards of ASTM C1249.
 - 7. Manufacturers:
 - a. Dow Corning Corporation: www.dowcorning.com/construction/sle.
 - b. Tremco Inc: www.tremcosealants.com.
 - c. Or prior approved equal.
- E. Weatherseal Sealant: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.
- F. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material.
- G. Glazing: As specified in Section 08 8000.
- H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- I. Glazing Accessories: As specified in Section 08 8000.

2.05 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than
 - 1. 0.7 mils 0 inch (0.02 mm) thick.

- B. Color: To be selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other related work.
- B. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
- C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

- A. Install curtain wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- H. Install firestopping at each floor slab edge.
- I. Pressure Plate Framing: Install glazing and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.
- J. Structural Sealant Glazing (SSG) Adhesive: Install structural sealant glazing adhesive and weatherseal sealant in accordance with manufacturer's instructions.
- K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inches (1.52 mm) every 3 feet (91.44 cm) non-cumulative or 0.5 inches (12.7 mm) per 100 feet (3048 cm), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.79 mm).
- C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch (19.05 mm) and minimum of 1/4 inch (6.35 mm).

3.04 FIELD QUALITY CONTROL

- A. Provide services of manufacturer's field representative to observe installation and submit report.
- B. Test installed curtain wall for water leakage in accordance with ASTM E331.
- C. Replace curtain wall components that have failed field testing and retest until performance is satisfactory.

3.05 ADJUSTING

- A. Adjust operating sash for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- C. Remove excess sealant by method acceptable to sealant manufacturer.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

**SECTION 087100
DOOR HARDWARE**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes commercial door hardware for the following:
1. Swinging doors.
 2. Sliding doors.
 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
1. Mechanical door hardware.
 2. Electromechanical door hardware.
 3. Cylinders specified for doors in other sections.
- C. Related Sections:
1. Division 08 Section "Hollow Metal Doors and Frames".
 2. Division 08 Section "Flush Wood Doors".
 3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 2. ANSI/SDI A250.13 - Testing and Rating of Severe Windstorm Resistant Components for Swing Door Assemblies.
 3. ICC/IBC - International Building Code.
 4. NFPA 70 - National Electrical Code.
 5. NFPA 80 - Fire Doors and Windows.
 6. NFPA 101 - Life Safety Code.
 7. NFPA 105 - Installation of Smoke Door Assemblies.
 8. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
1. ANSI/BHMA Certified Product Standards - A156 Series.
 2. UL10C - Positive Pressure Fire Tests of Door Assemblies.

3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.03 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.

- c. Wiring instructions for each electronic component scheduled herein.
- 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:
 - 1. Hurricane Resistant Openings: Exterior hurricane opening assemblies to be tested according to ASTM E330, ASTM E1886, ASTM E1996, TAS 201, TAS 202, TAS 203 standards, and certified by a qualified independent third party agency acceptable to authority having jurisdiction, with labeling indicating compliance with the design pressure and debris impact resistance level requirements specified for the Project.
 - 2. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.04 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.05 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware 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.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult

with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Hurricane Resistant Exterior Openings: Provide exterior door hardware as complete and tested assemblies, or component assemblies, including approved doors and frames specified under Section 081113 "Hollow Metal Doors and Frames", to meet the design pressures, debris impact resistance, and glass and glazing requirements applicable to the Project.
 - 1. Test units according to ASTM E330, ASTM E1886, ASTM E1996, TAS 201, TAS 202, and TAS 203 standards, certified by a qualified independent third party listing agency acceptable to authority having jurisdiction, and bearing a third party certification agency permanent label indicating windstorm approved product.
- G. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access controlled opening.
 - 4. Review and finalize construction schedule and verify availability of materials.
 - 5. Review the required inspecting, testing, commissioning, and demonstration procedures

- J. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.07 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.08 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties 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.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.

- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

1.01 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

1.02 MATERIALS

- A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

1.03 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

- a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
- 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
- 5. Manufacturers:
 - a. Hager Companies (HA) - BB Series, 5-knuckle.
 - b. Ives (IV) - 5BB Series, 5-knuckle.
 - c. McKinney (MK) - TA/T4A Series, 5-knuckle.

1.04 CONTINUOUS HINGES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 - 1. Manufacturers:
 - a. Hager Companies (HA).
 - b. Ives (IV).
 - c. Pemko (PE).

1.05 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
 - 1. Manufacturers:
 - a. Ives (IV) - Connect.
 - b. Pemko (PE) - SER-QC (# wires) Option.
- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to

junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

- a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
- b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

- a. Hager Companies (HA) - Quick Connect.
- b. McKinney (MK) - QC-C Series.
- c. Schlage (SC) - Connect.

1.06 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

- 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
- 2. Furnish dust proof strikes for bottom bolts.
- 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
- 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
- 5. Manufacturers:

- a. Ives (IV).
- b. Rockwood (RO).
- c. Trimco (TC).

B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

- a. Ives (IV).
- b. Rockwood (RO).
- c. Trimco (TC).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

- 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
- 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.

3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood (RO).
 - c. Trimco (TC).

1.07 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
 1. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA).
 - b. No Substitution
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Tubular deadlocks and other auxiliary locks.
 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 6. Keyway: Y2 keyway, No Substitution
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. System: Key locks as directed by the Owner.
- D. Key Quantity: Provide the following minimum number of keys:
 1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).
 3. Construction Keys (where required): Ten (10).
- E. Construction Keying: Provide construction master keyed cylinders.

F. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

1.08 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).

1.09 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:
 - a. Heavy duty 12-gauge wrought steel case.
 - b. Stainless steel 3/4" one-piece anti-friction reversible latchbolt with a one-piece hardened stainless steel 1" projection deadbolt.
 - c. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
 - d. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - e. Meets Florida Building Code FL2998 and UL Certification Directory ZHEM.R21744 for latching hardware for hurricane requirements.
 - f. Meets UL Certification Directory ZHLL.R21744 for products used in windstorm rated assemblies.
 - g. Status indicators inside, outside, or on both sides of doors as specified; available with wording for "locked/unlocked", "vacant/occupied" or custom wording options. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status.
 - h. Ten-year limited warranty for mechanical functions.
2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 8800FL Series.
 - b. Corbin Russwin Hardware (RU) - ML2000 Series.
 - c. Sargent Manufacturing (SA) - 8200 Series.
 - d. Schlage (SC) - L9000 Series.

1.010 CYLINDRICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.
 - 1. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 5400LN Series.
 - b. Corbin Russwin Hardware (RU) - CLX3300 Series.
 - c. Sargent Manufacturing (SA) - 10X Line.
 - d. Schlage (SC) - ND Series.

1.011 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 - 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 - 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 - 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 - 4. Dustproof Strikes: BHMA A156.16.

1.012 ELECTRIC STRIKES

- A. Standard Electric Strikes: Electric strikes conforming to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.
 - 1. Manufacturers:
 - a. HES (HS) - 1500/1600 Series.
 - b. Locknetics (LO) – MDS100 Series
 - c. Von Duprin (VD) – 6200/6400 Series
- B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

1.013 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
1. Exit devices shall have a five-year warranty.
 2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
1. Provide exit devices with functions and features as follows:
 - a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
 - b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - c. Meets Florida Building Code FL2998 and UL Certification Directory ZHEM.R21744 for latching hardware for hurricane requirements.
 - d. Meets UL Certification Directory ZHLL.R21744 for products used in windstorm rated assemblies.
 - e. Five-year limited warranty for mechanical features.

2. Electromechanical exit devices shall have the following functions and features:
 - a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
 - b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
 - c. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
 - d. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.
 - e. Five-year limited warranty for electromechanical features.
3. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 7000 Series.
 - b. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - c. Sargent Manufacturing (SA) - 80 Series.
 - d. Von Duprin (VD) - 35A/98 XP Series.

C. Security Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed rim panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be constructed of high grade, heat treated, corrosion resistant nickel steel alloy, and have a full 3/4" throw projection with slide action positive deadlocking.

1. Static Load Force Resistance: Minimum 3000 lbs. certified independent tested.
2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 7050 Series.
 - b. Corbin Russwin Hardware (RU) - ED4000S / ED5000S Series.

D. Steel Removable Mullions: ANSI/BHMA A156.3 steel removable mullions with options for fire rating, locking, through-wire electrification and hurricane compliance as specified.

1. Provide mullions with functions and features as follows:
 - a. At openings designed for severe wind load conditions due to hurricanes or tornadoes, provide manufacturer's certified mullion and accessories to meet applicable state and local windstorm codes.
 - b. Provide keyed removable feature where specified in the Hardware Sets.
 - c. Provide stabilizers and mounting brackets as required.
2. Manufacturers:
 - a. Same as exit device manufacturer.

1.014 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Heavy duty surface mounted door closers shall have a 30-year warranty.
 2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 4400 Series.
 - b. Corbin Russwin Hardware (RU) - DC6000 Series.
 - c. LCN Closers (LC) - 4040 Series.
 - d. Sargent Manufacturing (SA) - 351 Series.
- C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.
1. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - Unitrol Series.
 - b. Corbin Russwin Hardware (RU) - Unitrol Series.

1.015 ARCHITECTURAL TRIM AND ACCESSORIES

A. Door Protective Trim:

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood (RO).
 - c. Trimco (TC).

1.016 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood (RO).
 - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Manufacturers:
 - a. Norton Rixson (RF).
 - b. Rockwood (RO).
 - c. Sargent Manufacturing (SA).

1.017 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Hurricane and Storm Shelter Compliance: Devices to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or storm shelter products that have been independently third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.
- G. Manufacturers:
 - 1. National Guard Products (NG).
 - 2. Pemko (PE).
 - 3. Zero (ZE).

1.018 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
 - 1. Manufacturers:
 - a. Alarm Controls (AK) - CP1-1026 Series.
 - b. Sargent Manufacturing (SA) – 3280 Series
 - c. Securitron (SU) - DPS Series.

- B. Intelligent Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Power supplies shall meet all functions and features as specified herein.
 - a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.
 - b. Dedicated fast charger to prolong battery life with low battery cutoff to protect batteries from deep discharge.
 - c. Enhanced surge immunity for input/output protection
 - d. Separate, dedicated battery charging circuit to keep locks cooler.
 - e. Dual-color LED visual notification to prevent applying incorrect voltages to the power supply.
 - f. Instant auto-switch to battery on AC loss.
 - g. Expandable up to 16 outputs in the standard enclosure
 - h. Integrated fire alarm interface to allow main output shutdown or disconnect on a per output basis when using an R8 output module.
 - i. Network ready and remotely manage locks and connected devices when using an M8 managed output module on network models.
 - j. Lifetime replacement, no-fault, no questions asked warranty.
2. Manufacturers:
 - a. Altronix (AS) – Maximal 11F
 - b. Life Safety Power (LP)
 - c. Securitron (SU) - AQL Series.

1.019 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

1.020 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

1.01 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

1.02 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

1.03 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

1.04 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

1.05 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1.06 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

1.07 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

1.08 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a

hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. YA - ASSA ABLOY ACCENTRA
5. HS - HES
6. NO - Norton Rixson
7. OT - Other
8. SU - Securitron

Hardware Sets

Set: 1.0

Doors: 100X, 103

Description: AUTOMATIC SLIDER

1 Cylinder	Type As Required	626	YA

Notes:

- Balance of hardware furnished by the automatic sliding door manufacturer.
- Automatic sliding door supplier to verify cylinder type, quantity & finish required - IF ANY.
- Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.
- Provide blocking/spacer rings in thickness as required to fill gap, if any, between cylinder head and face of door.

Set: 2.0

Doors: 102EE, 107

Description: EXTERIOR - ALUM - ADMIN, MEETING ROOM (CR)

1 Continuous Hinge	CFM__SLF-HD1 SER__ x L.A.R.		PE	⚡
1 Rim Exit Device, Nightlatch	7250MWS B MELR 481F 1109 x 6-Pin SN-134	630	YA	⚡
1 Surface Closer w/ Stop Arm	UNIJ4400	689	YA	
1 Back Plate	486	689	YA	
1 ElectroLynx Harness [frame]	QC-C1500P		MK	⚡
1 ElectroLynx Harness [door]	QC-C**** (length / type as required)		MK	⚡

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DOOR HARDWARE

1 Door Position Switch	DPS-M / W-BK	SU	⚡
1 Card Reader	Provided By Security Supplier		⚡
1 Power Supply	AQL Series (Type & Size as Required)	SU	⚡
1 Wiring/Point-to-Point Diagram			
1 Elevation Diagram			
1 Riser Diagram			

Notes:

*Minimum Stile Width: 4-1/2"

-Hardware listed for design criteria ONLY, confirm with the specific aluminum storefront door and frame manufacturer the hardware requirements to meet the windstorm/design pressure level and debris impact resistance requirements specified for the project.

-Balance of hardware: Threshold, door sweep and perimeter gasket furnished by the aluminum storefront door and frame manufacturer.

-Coordinate all hardware with the aluminum storefront door and frame manufacturer/supplier.

-Provide necessary drop plates and fillers for proper installation of door closer.

-Verify finish of hardware.

-Coordinate with electrical, alarm and security contractors.

-Access control panel, security management software and credentials by Security Contractor.

Operational Narrative:

1. Door normally closed and secure.
2. Authorized access by card reader retracting exit device latch for predetermined time limit.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Exit device latch releases (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 3.0

Doors: 109

Description: EXTERIOR - ALUM - PAIR - PATRON

2 Continuous Hinge	CFM__SLF-HD1 x L.A.R.		PE
1 Key Removable Mullion	KRM200FWS x L.A.R.	600	YA
2 Rim Exit Device, Classroom	7250MWS AU506F 1109 x 6-Pin SN-134	630	YA
1 Mullion Cylinder Kit	AMCK2 2153 x 6-Pin	630	YA
2 Surface Closer w/ Stop Arm	UNIJ4400	689	YA
2 Back Plate	486	689	YA

Notes:

*Minimum Stile Width: 4-1/2"

-Hardware listed for design criteria ONLY, confirm with the specific aluminum storefront door and frame

manufacturer the hardware requirements to meet the windstorm/design pressure level and debris impact resistance requirements specified for the project.

-Balance of hardware: Threshold, door sweep and perimeter gasket furnished by the aluminum storefront door and frame manufacturer.

-Coordinate all hardware with the aluminum storefront door and frame manufacturer/supplier.

-Provide necessary drop plates and fillers for proper installation of door closers.

-Exit devices can be dogged down for push / pull operation.

-Verify finish of hardware.

Set: 4.0

Doors: 119

Description: EXTERIOR - ELEC.

1 Continuous Hinge	CFM__SLF-HD1 x L.A.R.		PE
1 Rim Exit Device, Nightlatch	7150WS AU627F 1109 x 6-Pin SN-134	630	YA
1 Surface Closer w/ Stop Arm	UNI4400 TBGN	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Rain Guard	346C TKSP x Frame Width		PE
1 Gasketing	303CSTST (Head & Jambs)		PE
1 Sweep	315CN TKSP x Door Width		PE
1 Threshold	2005AT MSES25SS x L.A.R.		PE

Notes:

-Hardware listed for design criteria, confirm with the specific door and frame manufacturer the hardware requirements to meet the windstorm/design pressure level and debris impact resistance requirements specified for the project.

Set: 5.0

Doors: 120

Description: EXTERIOR - PAIR - MECHANICAL

2 Continuous Hinge	CFM__SLF-HD1 x L.A.R.		PE
2 Manual Flush Bolt	556WS	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Storeroom Lock	AUR 8840FL	626	YA
1 Surf Overhead Stop	9ADJ-x36	630	NO
1 Surface Closer w/ Stop Arm	UNI4400 TBGN	689	YA
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Astragal	357SP x Door Height		PE
1 Rain Guard	346C TKSP x Frame Width		PE
1 Gasketing	303CSTST (Head & Jambs)		PE
2 Sweep	315CN TKSP x Door Width		PE
1 Threshold	2005AT MSES25SS x L.A.R.		PE

Notes:

- Hardware listed for design criteria, confirm with the specific door and frame manufacturer the hardware requirements to meet the windstorm/design pressure level and debris impact resistance requirements specified for the project.
- Overhead stop for inactive door.
- Surface closer for active door.
- Delete astragal if provided by the door manufacturer.

Set: 6.0

Doors: 102

Description: PAIR - MEETING ROOM

8 Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK
2 Fire Rated Surf Vert Rod, Classroom	7170F LBR AU626F 1109 x 6-Pin SN-134	630	YA
2 Surface Closer	4400 TBGN (mount as req'd per application)	689	YA
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO
2 Door Stop	403 (or) 446 (As Req'd)	US26D	RO
2 Astragal	18041CNB x Door Height		PE
1 Gasketing	S88BL (Head & Jambs)		PE

Notes:

- Closers shall not be installed on corridor side of doors, where possible install closers on doors for optimum aesthetics.

Set: 7.0

Doors: 105

Description: ALUM - PAIR - LA ROOM

2 Continuous Hinge	CFM__SLF-HD1 x L.A.R.		PE
2 Concealed Vert Rod Exit, Classroom	7220 AU506F 1109 x 6-Pin SN-134	630	YA
2 Surface Closer w/ Stop Arm	UNIJ4400	689	YA
2 Back Plate	486	689	YA
1 Perimeter Gasket/Seal	By Aluminum Storefront Door and Frame Manufacturer		OT

Notes:

- Coordinate all hardware with the aluminum storefront door and frame manufacturer/supplier.
- Provide necessary drop plates and fillers for proper installation of door closers.
- Exit devices can be dogged down for push / pull operation.
- Verify finish of hardware.

Set: 8.0

Doors: 102A

Description: PAIR - STORAGE

8 Hinge, Full Mortise	TA2714	US26D	MK
1 Auto Flush Bolt Set	2842 / 2962 (As Required)	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Storeroom or Closet Lock	AU 5405LN 480B	626	YA
1 Coordinator	1700	Black	RO
2 Surface Closer	4400 TBGN (mount as req'd per application)	689	YA
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO
2 Door Stop	403 (or) 446 (As Req'd)	US26D	RO
1 Astragal	357SP with S88BL x Door Height		PE
1 Gasketing	S88BL (Head & Jambs)		PE

Notes:

-Closers shall not be installed on corridor side of doors, where possible install closers on doors for optimum aesthetics.

Set: 9.0

Doors: 116

Description: STORAGE

4 Hinge, Full Mortise	TA2714	US26D	MK
1 Storeroom or Closet Lock	AU 5405LN	626	YA
1 Door Stop	403 (or) 446 (As Req'd)	US26D	RO
3 Silencer	608-RKW		RO

Set: 10.0

Doors: 112A, 114, 115

Description: IT, JANITOR, STORAGE

4 Hinge, Full Mortise	TA2714	US26D	MK
1 Storeroom or Closet Lock	AU 5405LN	626	YA
1 Surface Closer	4400 TBGN (mount as req'd per application)	689	YA
1 Mop Plate	K1050 4" high CSK BEV	US32D	RO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Door Stop	403 (or) 446 (As Req'd)	US26D	RO
1 Gasketing	S88BL (Head & Jambs)		PE

Notes:

- Closers shall not be installed on corridor side of doors, where possible install closers on door for optimum aesthetics.
- Mop plate for JANITOR door only.

Set: 11.0

Doors: 100d, 102B, 108, 115a

Description: ADMIN, BOOK DROP, OFFICE, STORAGE (CR)

4 Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	
1 Storeroom or Closet Lock	AU 5405LN	626	YA	
1 Electric Strike	1500C	630	HS	⚡
1 Surface Closer	4400 TBGN (mount as req'd per application)	689	YA	
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	
1 Door Stop	403 (or) 446 (As Req'd)	US26D	RO	
1 Gasketing	S88BL (Head & Jambs)		PE	
1 ElectroLynx Harness [frame]	QC-C1500P		MK	⚡
1 Door Position Switch	DPS-M / W-BK		SU	⚡
1 Card Reader	Provided By Security Supplier			⚡
1 Power Supply	AQL Series (Type & Size as Required)		SU	⚡
1 Wiring/Point-to-Point Diagram				
1 Elevation Diagram				
1 Riser Diagram				

Notes:

- Closers shall not be installed on corridor side of doors, where possible install closers on door for optimum aesthetics.
- Coordinate with electrical, alarm and security contractors.
- Access control panel, security management software and credentials by Security Contractor.

Operational Narrative:

1. Door normally closed and secure.
2. Authorized access by card reader releasing electric strike.
3. Egress free for immediate exit.
4. Door position switch monitors open/closed status.
5. Electric strike remains locked (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 12.0

Doors: 115b

Description: OFFICE

4 Hinge, Full Mortise	TA2714	US26D	MK
1 Entry Lock	AU 5407LN	626	YA
1 Door Stop	403 (or) 446 (As Req'd)	US26D	RO
3 Silencer	608-RKW		RO

Set: 13.0

Doors: 118

Description: STAFF BREAK ROOM

4 Hinge, Full Mortise	TA2714	US26D	MK
1 Classroom Lock	AU 5408LN	626	YA
1 Door Stop	403 (or) 446 (As Req'd)	US26D	RO
3 Silencer	608-RKW		RO

Set: 14.0

Doors: 109B, 117

Description: FAMILY/STAFF RESTROOM

4 Hinge, Full Mortise	TA2714	US26D	MK
1 Privacy Lock	AU 5402LN	626	YA
1 Surface Closer	4400 TBGN (mount as req'd per application)	689	YA
1 Mop Plate	K1050 4" high CSK BEV	US32D	RO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Door Stop	403 (or) 446 (As Req'd)	US26D	RO
1 Gasketing	S88BL (Head & Jambs)		PE

Notes:

-Closers shall not be installed on corridor side of doors, where possible install closers on door for optimum aesthetics.

-Mop plate for inswing doors only.

Set: 15.0

Doors: 104, 106, 111, 113

Description: STUDY

4 Hinge, Full Mortise	TA2714	US26D	MK
1 Passage Latch	AU 5401LN	626	YA

1 Door Stop	403 (or) 446 (As Req'd)	US26D	RO
1 Perimeter Gasket/Seal	By Aluminum Frame Manufacturer		OT

Set: 16.0

Doors: 101A, 101B

Description: MULTI-USE RESTROOM

4 Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK
1 Push Plate	70C-RKW	US32D	RO
1 Pull Plate	BF 110x70C	US32D	RO
1 Surface Closer	4400 TBGN (mount as req'd per application)	689	YA
1 Mop Plate	K1050 4" high CSK BEV	US32D	RO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Door Stop	403 (or) 446 (As Req'd)	US26D	RO
3 Silencer	608-RKW		RO

Notes:

-Closers shall not be installed on corridor side of doors, where possible install closers on door for optimum aesthetics.

END OF SECTION 087100

SECTION 08 8000 GLAZING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Doors
 - 2. Storefront framing
 - 3. Glazed entrances
- B. Related Sections
 - 1. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.
 - 2. Section 08 4313 - Aluminum-Framed Storefronts:
 - 3. Section 08 8300 - Mirrors.
 - 4. Section 08 4413 - Glazed Aluminum Curtain Walls.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- C. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
- D. ASTM C1036 - Standard Specification for Flat Glass; 2025.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.
- F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024, with Editorial Revision (2025).
- G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.
- H. GANA (LGRM) - Laminated Glazing Reference Manual; 2019.
- I. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (Reaffirmed 2016).

1.04 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.
- D. Deterioration of Coated Glass: Defects developed from normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- E. Deterioration of Laminated Glass: Defects developed from normal use that is attributed to the manufacturing process and not causes other than glass breakage and practices for 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.

- F. Laminated Glass Unit Surface Designations:
1. Surface 1 - Exterior surface of the outer glass lite.
 2. Surface 2: Interior surface of the outer glass lite.
 3. Surface 3: Exterior surface of the inner glass lite.
 4. Surface 4: Interior surface of the inner glass lite.

1.05 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.
1. Glass Design: Glass thickness designations indicated are minimum and are for detailing only. Confirm glass thickness by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than the thicknesses and strengths (annealed or heat treated) required to meet or exceed the following criteria.
 2. Design Wind Loads: Determine design wind loads applicable to the Project according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures" Section 6.5, "Method 2 - Analytical Procedure" based on mean roof heights above grade indicated on Drawings.
- B. Structural Performance and Delegated Design: Engage a qualified engineer to design glazing, including comprehensive engineering analysis, to withstand the following design loads within the limits and under conditions indicated determined according to the IBC and ASTM E 1300:
1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Wind Design Data: As indicated on the Structural Drawings.
 2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
 5. Seismic Importance Factor: 1.25
 6. Risk Category: III
 7. Basic Ultimate Wind Speed: 148 miles per hour
 8. Basic Nominal Wind Speed: 115 miles per hour
 9. Exposure: C
 10. Internal Pressure Coefficient: +/- 0.18.
 11. Refer to Structural Drawings for Additional Load Design Criteria.
 12. Deflection Limits: For glass supported on all four edges, limit center of glass deflection at design wind pressure to not more than 1/50 times the short side length of 1 inch, whichever is less.
- C. Glass Thickness: Select minimum glass thicknesses to comply with ASTM E1300, according to the following requirements:
1. Specified Design Wind Loads: As indicated on the Structural Drawings, but not less than the wind loads applicable to the Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures" Section 6.0 "Wind Loads".
 2. Probability for Breakage for Vertical Glazing: 8 lites per 100 lites set vertically or not more than 15 degrees off vertical and under wind action.

3. Minimum Glass Thickness for Exterior Lites: Not less than 6.0mm.
 4. Thickness for Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated in the Project.
 5. Windbourne Debris Impact Resistance Test Performance: Provide glazing for aluminum framed systems that pass large and small missile impact tests and cyclic pressure tests according to the requirement of the International Building Code.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components. 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.
- E. Impact Resistance: System to meet requirements for coastal hurricane missile impact loads.
1. Glazing up to 30 feet above grade shall be designed for Large Missile Impact (LMI) in accordance with ASTM E96 and SSTD 12.
 2. Glazing 30 feet to 60 feet above grade shall be designed for Small Missile Impact (SMI) in accordance with ASTM E96 and SSTD 12.
- F. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
1. Provide safety glazing at all locations noted below:
 - a. Within 48 inches of finished floor.
 - b. Immediately adjacent to any swinging door opening.
 - c. At a lite within a door.
 - d. Any location specifically indicated in this Section or on the Drawings to be tempered.
- G. 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 laminated-glass lites, properties are based on products of construction indicated.
 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 4. 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 (W/sq. m x K).
 5. 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.
 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

1.06 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
 1. Weatherproofing system, including printed statement of VOC content.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
 1. Fire-rated glass.
 2. Insulating glass.
 3. Insulating spandrel glass.
- C. Glazing Accessory Samples: For gaskets, in 12-inch lengths.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.07 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers and manufacturers of insulating-glass units with sputter-coated, low-e coatings.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Warranties: Sample of special warranties.

1.08 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. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations 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: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- E. Safety Glazing Labeling: Where safety glazing labeling 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.
 - 1. Provide tempered safety glass where required for compliance with CPSC 16CFR 1201 and where otherwise indicated on the Drawings.
- F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- G. 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 temporary protection requirements for glazing during and after installation.

1.09 MOCK-UP

- A. See Section 01 4000 - Quality Requirements, for additional mock-up requirements.
- B. Locate where directed by Architect.

1.10 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 recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.11 PROJECT 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 below 40 deg F.

1.12 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: Ten (10) years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which 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.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which 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.
- D. Manufacturer's Special Warranty on Fire-Rated Glass: Manufacturer's standard form, made out to Owner and signed by fire-rated glass manufacturer agreeing to replace fire-rated glass units that deteriorate within specified warranty period indicated.
 - 1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. 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 6.0 mm thick.
 - 2. For laminated glass lites, properties are based on products of construction indicated.
 - 3. For insulating glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 4. 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.
 - 5. 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.
 - 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.02 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

- 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.
- C. Heat-Strengthened Float Glass: ASTM C 1048; Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated; Type I, Class I (clear) unless otherwise 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.
 - 2. For coated vision glass, comply with requirements for Condition C (other coated glass).
- D. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.

2.03 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, and complying with other requirements specified.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
 - 2. Spacer: Manufacturer's standard spacer material and construction.
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both.
- B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.04 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. Neoprene complying with ASTM C 864.
 - 2. EPDM complying with ASTM C 864.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.05 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will 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 inside the weatherproofing system, 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 100/50, Use NT, G, and A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. May National Associates, Inc.; Bondaflex Sil 290.
 - d. Sika Corporation U.S.; Sikasil WS-290.
 - e. Tremco Incorporated; Spectrem 1.

2. Applications: Wet glazing for other than structural-sealant-glazed curtainwall systems.
- C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT, G, and A.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 795.
 - b. GE Advanced Materials - Silicones; SilPruf SCS2000.
 - c. May National Associates, Inc.; Bondaflex Sil 295.
 - d. Sika Corporation U.S.; Sikasil WS-295.
 - e. Tremco Incorporated; Spectrem 2.
 2. Applications: Structural-sealant-glazed curtainwall systems.
- D. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT, G, and A.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 799.
 2. Applications: Two-sided butt-glazed glazing in interior conditions.
 3. Joint Sealant Color: Clear.

2.06 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. 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).

2.07 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.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

2.08 MONOLITHIC GLASS TYPES

- A. **Glass Type GL-1:** Clear fully tempered float glass.
 1. Thickness 6.0 mm unless otherwise required to meet the performance requirements determined in the delegated design.
 2. Provide safety glazing labeling.

2.09 INSULATING GLASS UNITS

- A. **Glass Type IG-1:** Low-e-coated, clear insulating glass, impact resistant:
 1. Products: All exterior glazing unless otherwise indicated. All exterior doors, unless otherwise noted shall receive impact rated and safety glazing as required per International Building Code. All exterior openings shall comply with the Large Missile Impact Testing. Subject to compliance with requirements, provide one of the following products:
 - a. Guardian Industries; "SuperNeutral 68 (2) on Gray + Clear, with minimum 0.90 inch thick interlayer polyvinyl butryl plastic."

- b. Vitro Architectural Glass.; "Solarban 60 (2) Solargray + Clear, with minimum 0.90 inch thick interlayer polyvinyl butryl plastic."
 2. Overall Unit Thickness: 1.4" (35 mm).
 3. Thickness of Each Glass Lite: 1/4" (6 mm).
 4. Thickness of Polyvinyl Butryl Plastic Interlayer: 0.90 inch (23 mm)
 5. Outdoor Lite: Class 1 (clear) float heat strengthened glass.
 6. Low-E Coating: Second surface.
 7. Interspace Content: Air.
 8. Indoor Lite: Class 1 (clear) float glass.
 9. Visible Light Transmittance: 35 percent minimum.
 10. Winter Nighttime U-Factor: 0.29 maximum.
 11. Summer Daytime U-Factor: 0.27 maximum.
 12. Solar Heat Gain Coefficient: 0.25 maximum.
 13. Shading Coefficient: 0.29.
 14. Exterior Visible Light Reflectance: 6 percent.
 15. Provide tempered safety glazing where required for compliance with CPSC 16CFR 1201 and where otherwise indicated on the Drawings.
- B. **Glass Type IG-8** (LMI) Door Lites & Automatic Glazed Entrances: Low-e-coated, clear insulating glass for hurricane impact:
 1. Products: Subject to compliance with requirements, provide one of the following products:
 - a. Guardian Industries; "SunGuard SuperNeutral 68 on Clear (2) + Airspacer + Clear/Clear Laminated Inboard Lite."
 - b. Vitro; "Solarban 60 on Clear (2) + Airspacer + Clear/Clear Laminated Inboard Lite."
 2. Overall Unit Thickness: Minimum 25 mm.
 3. Minimum Thickness of Each Glass Lite: 3/16".
 4. Outdoor Lite: Class 1 (clear) float heat strengthened glass.
 5. Low-E Coating: Second surface.
 6. Interspace Content: Air or Argon.
 7. Indoor Lite: Class 1 (clear) float glass.
 8. Visible Light Transmittance: 34 percent minimum.
 9. Winter Nighttime U-Factor: 0.29 maximum.
 10. Summer Daytime U-Factor: 0.27 maximum.
 11. Solar Heat Gain Coefficient: 0.22 maximum.
 12. Solar Energy Transmittance: 15 percent maximum.
 13. Ultra-Violet Transmittance: 5 percent maximum.
 14. Shading Coefficient: 0.26.
 15. Exterior Visible Light Reflectance: 6 percent.
 16. Provide tempered safety glazing where required for compliance with CPSC 16CFR 1201 and where otherwise indicated on the Drawings.
 17. Provide HS or Tempered glass as required by hurricane impact test requirements of associated door and framing product.
 18. Where used in Large Missile Impact location on project; Provide PVB, SGP, or equivalent laminate interlayer, of thickness required by hurricane impact test requirements of associated door and framing product.

2.10 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; hardness range of 5 to 30 cured Shore A durometer; coiled on release paper; black color.
 - 1. Manufacturers:
 - a. Pecora Corporation: www.pecora.com.
 - b. Tremco Global Sealants: www.tremcosealants.com.
- D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; ____ color.
- E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 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.

3.02 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. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- 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 in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

- K. 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.
- L. 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.

3.03 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. Install gaskets so they protrude past face of glazing stops.

3.04 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. 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; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project 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.

**SECTION 08 8400
PLASTIC GLAZING**

PART 1 – GENERAL

1.01 REFERENCE STANDARDS

- A. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2024.
- C. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.
- D. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2022.
- E. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2017.
- F. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2023.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

1.02 SECTION INCLUDES

- A. Polycarbonate plastic glazing
- B. Enhanced UV-resistant polycarbonate plastic glazing.
- C. Laminated polycarbonate plastic glazing.

1.03 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Section 07900 – Joint Sealers
- C. Section 08520 – Aluminum Windows
- D. Section 08630 – Metal-Framed Skylights
- E. Section 08800 - Glazing
- F. Section 08850 – Glazing Accessories
- G. Section 08910 – Metal-Framed Curtain Wall

1.04 REFERENCES

- A. ANSI Z97.1 - American National Standard for Glazing Materials Used in Buildings -- Safety Performance Specifications and Methods of Test.
- B. ASTM D256 - Standard Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
- C. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
- D. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- E. ASTM D1929 - Standard Test Method for Ignition Properties of Plastics.
- F. ASTM D635 – Standard Test Method for Rate of Building and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- G. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
- H. CAN/ULC 102.2 – Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

1.05 SUBMITTALS

- A. General: Submit the following in accordance with conditions of contract and Division 1 specification section 01 33 00 "Submittal Procedures".
- B. Product Data: Submit manufacturer's product data; including product description, fabrication information, and compliance with specified performance requirements.
- C. Submit product test reports from a qualified independent 3rd party testing agency indication each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed test reports will be acceptable if for current manufacturer and indicative of products used on this project.
 - 1. Test reports required are:
 - a. Rate of Burning ((ASTM D635)))
 - b. Self-Ignition Temperature (((ASTM D1929)))
 - c. Flame Spread and Smoke Developed (((ASTM E84)))
 - d. Impact Strength (ASTM D 3763)
 - e. Safety Glazing and Impact Strength (((ANSI Z97.1))-2004)
- D. Samples for Initial Selection:
 - 1. Submit minimum 2-inch by 2-inch samples. Indicate full color.
- E. Samples for Verification:
 - 1. Submit minimum 4-inch by 4-inch sample for each type and color of solid plastic fabrication.
- F. Mockups:
 - 1. Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects.
 - 2. Build mockup of each type of Plastic Fabrication.
 - 3. Approved mockups may become part of the completed work if undistributed at time of Substantial Completion.
- G. Maintenance Data: Submit manufacturer's care and maintenance data, including care, repair and cleaning instructions. Include in Project closeout documents.
- H. Delegated Design: Provide Louisiana PE-stamped shop drawings and calculations for the exterior polycarbonate systems. This delegated design shall also include anchorage to supporting structure or walls as applicable. Design shall meet the load requirements as required by the International Building Code and as required by the Authority having Jurisdiction.
- I. Shop Drawings: Include plans with overall dimensions, construction, and anchorage details.
 - 1. For delegated design items, include sealed drawings and calculations by a Professional Engineer licensed in the State of Louisiana.

1.06 QUALITY ASSURANCE

- A. Manufacturer's Qualifications
 - 1. Materials and systems shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least five (5) consecutive years and which can show evidence of those materials being satisfactory used on at least six (6) projects of similar size, scope and location.
 - 2. Manufacturer must have documented training and qualification program for fabrication and installation of plastic fabrications.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver Plastic Fabrications, systems and specified items in manufacturer's standard protective masking.
- B. Store materials in a flat orientation in a dry place that is not exposed to exterior elements.
- C. Handle materials to prevent damage to finished surfaces.
- D. Before installing Plastic Fabrications, permit them to reach room temperature.

- E. Do not deliver Plastic Fabrications, systems, components and accessories to Project site until areas are ready for installation.

1.08 WARRANTY

- A. Manufacturer's Special Warranty on Plastic Fabrications: Manufacturer's standard form agreeing to repair or replace units that fail in material or workmanship within the specified warranty period.
- B. Warranty Period: 5 years from ship date.
- C. The warranty shall not deprive the owner of other rights or remedies the Owner may have under provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Manufacturer: 3form, Inc., Salt Lake City, Utah, USA / telephone 801-649-2500
- B. Uniquad, by Kingspan; www.kingspan.com
- C. Or prior approved equal.
- D. Substitutions: See Section 01 6000-Product Requirements.

2.02 MATERIALS

- A. (Basis of Design) Varia Ecoresin Panel product. Refer to Interior Finish schedule on the Drawings.
 - 1. Engineered polycarbonate resin
 - 2. Sheet Size: As indicated on the Drawings.
 - 3. Thickness: 1/2" Thick
 - 4. Basis of Design Product: The design of Plastic Fabrications is based on Varia Ecoresin as provided by 3form, Inc. Products from other manufacturers must be approved by the Architect and Designer prior to bidding in accordance with the Instructions to Bidders and Section 10 60 00 "Product Requirements".
- B. Sheet Minimum Performance Attributes:
 - 1. Rate of Burning (((ASTM D635))). Material must attain CC1 Rating for a nominal thickness of 1.5 mm (0.060 inch (1.52 mm).) and greater.
 - 2. Self-Ignition Temperature (((ASTM D1929))). Material must have a Self-Ignition Temperature greater than 650°F.
 - 3. Flame Spread and Smoke developed testing (((ASTM E84))). Material must be able to meet a level of Class B (Flame spread less than 75 and smoke less than 450) at thickness of 1/2".
 - 4. Impact Strength. Minimum impact strength test as measured by ASTM D 3763 of 20 feet (609.6 cm) lbs. (for durability, shipping, installation, and use).
 - 5. Safety Glazing. Material must attain a Class A impact rating in accordance with ANSI Z97.1-2004.
- C. Interlayer Materials:
 - 1. C3 Color: Play with 50,000 options in the core color palette. Combine colors up to three layers deep to control the hue, intensity and translucency, creating an exciting range of exact color specifications.
 - 2. HighRes: Translucent high resolution imagery.

2.03 FABRICATION

- A. General: Fabricate Plastic Fabrications to designs, sizes and thicknesses indicated and to comply with indicated standards. Sizes, profiles and other characteristics are indicated on the drawings.

- B. Comply with manufacturer's written recommendations for fabrication.
- C. Machining: Acceptable means of machining are listed below. Ensure that material is not chipped or warped by machining operations.
 - 1. Sawing: Select equipment and blades suitable for type of cut required.
 - 2. Drilling: Drills specifically designed for use with plastic products.
 - 3. Milling: Climb cut where possible.
 - 4. Routing
 - 5. Tapping
- D. Forming: Form products to shapes indicated using the appropriate method listed below. Comply with manufacturer's written instructions.
 - 1. Cold Bending
 - 2. Hot Bending
- E. Laminating: Laminate to substrates indicated using adhesives and techniques recommended by manufacturer.

2.04 ACCESSORIES

- A. Gaskets shall be as per manufacturer's standards to meet performance criteria.
- B. Fasteners shall be per manufacturer's standards to meet performance requirements.

2.05 MISCELLANEOUS MATERIALS

- A. General: Provide products of material, size, and shape required for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaner: Type recommended by manufacturer.
- C. Fasteners: Use screws designed specifically for plastics.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of Plastic Fabrications will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for installation and comply with requirements specified.

3.02 INSTALLATION

- A. General: Comply with manufacturer's written instructions for the installation of Plastic Fabrications.
- B. Manufacturer's shop to fabricate items to the greatest degree possible.
- C. Utilize all fasteners recommended by manufacturer for type of installation indicated. Material that is chipped, warped, hazed or discolored as a result of installation or fabrication methods will be rejected.
- D. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
- E. We recommend that installation is completed by a 3form Certified Installer. Contact 3form for more information or to get a quote.

3.03 CLEANING AND PROTECTION

- A. Protect surfaces from damage until date of substantial completion. Repair work or replace damaged work, which cannot be repaired to Architect's satisfaction.

**SECTION 08 8723
DECORATIVE FILMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Decorative Glazing films applied to new glazing assemblies.
- B. Glazing assemblies to receive film are indicated on drawings.

1.02 RELATED REQUIREMENTS

- A. Section 08 8000 - Glazing: New glazing to received film.

1.03 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Record of product certification for safety requirements.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- C. Shop Drawings: Detailing installation of film, anchoring accessories, and sealant.
- D. Samples: For each film product to be used, minimum size 4 inches (102 mm) by 6 inches (152 mm), representing actual product, color, and patterns.
- E. Test Reports: Detailed reports of full-scale chamber tests to specified criteria, using assemblies identical to those required for this project.
- F. Specimen Warranty.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Glazing film manufacturer specializing in manufacture of safety glazing films with minimum 10 years successful experience.
- B. Installer Qualifications: Certified by glazing film manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of authorities having jurisdiction.

1.06 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

- A. Provide 5 year manufacturer's replacement warranty to cover film against peeling, cracking, discoloration, and deterioration.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. **DF-1** - Solyx: www.solyxfilms.com
- B. Or prior approved equal.

2.02 MATERIALS

- A. Decorative Glazing Films (**DF-1**): Transparent, translucent or patterned polyester film for permanent bonding to glass.
 - 1. Basis of Design: Solyx SC-3131 Eco Dusted

2. Thickness: 3 mil
3. Film Type: Polyester
4. Opacity: Frosted
5. Adhesive Type: Clear, pressure sensitive acrylic, permanent adhesive.
6. Shading Coefficient: 93
7. Visible Light Reflection: 69%
8. Visible Light Transmission: 59%
9. UV Transmission: 45%
10. Solar Heat Reflection: 68%
11. Solar Heat Transmission: 32%
12. Infra-Red Transmission: 66%

B. Accessory Materials: As recommended or required by film manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine glass and frames. Verify that existing conditions are adequate for proper application and performance of film.
- B. Verify glass is not cracked, chipped, broken, or damaged.
- C. Verify that frames are securely anchored and free of defects.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean glass of dust, dirt, paint, oil, grease, mildew, mold, and other contaminants that would inhibit adhesion.
- B. Immediately prior to applying film, thoroughly wash glass with neutral cleaning solution.
- C. Protect adjacent surfaces.
- D. Do not begin installation until substrates have been properly prepared.

3.03 INSTALLATION

- A. Do not apply glazing film when surface temperature is less than 40 degrees F (4 degrees C) or if precipitation is imminent.
- B. Install in accordance with manufacturer's instructions, without air bubbles, wrinkles, streaks, bands, thin spots, pinholes, or gaps, as required to achieve specified performance.
- C. Accurately cut film with straight edges to required sizes allowing 1/16 inch (2 mm) to 1/8 inch (3 mm) gap at perimeter of glazed panel unless otherwise required by anchorage method.
- D. Seams: Seam film only as required to accommodate material sizes; form seams vertically without overlaps and gaps; do not install with horizontal seams.
- E. Clean glass and anchoring accessories following installation. Remove excess sealants and other glazing materials from adjacent finished surfaces.
- F. Remove labels and protective covers.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**SECTION 09 2116
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Cementitious backing board.
- E. Gypsum wallboard.
- F. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 05 4000 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing, and interior framing as indicated.
- B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 2100 - Thermal Insulation: Acoustic insulation.
- D. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- E. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

- A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
- B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
- C. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2012.
- D. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.
- E. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.
- F. ANSI A108/A118/A136.1 - Specifications for the Installation of Ceramic Tile; 2020.
- G. ANSI A108/A118/A136.1 - Specifications for the Installation of Ceramic Tile; 2020.
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- I. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
- J. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2024.
- K. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- L. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.
- M. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022, with Editorial Revision (2023).
- N. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- O. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

- P. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
- Q. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- R. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.
- S. UL (FRD) - Fire Resistance Directory; Current Edition.
- T. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
 - 1. Shop drawings shall include framing member gauge and size, based on the framing manufacturer's height and span limits.
 - 2. STC ratings: Shop drawings shall include framing member spacing and gauge, based on the required STC ratings indicated on the Drawings.
 - 3. For review by the Architect, include potential conflicts between requirements of partition framing heights, and framing member gauge where STC ratings are required.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum ____ years of experience , with minimum 5 years of documented experience.
- B. Single Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board or from a manufacturer acceptable to gypsum board manufacturer.

1.06 MOCK-UP

- A. Apply mock-ups of each wall texture and finish level system indicated to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each texture and finish level system specified.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other items: Architect will designate items or areas required.
 - 2. Final approval of finish and texture selections will be based on mockups.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface combination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.
- C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.08 PROJECT CONDITIONS

- A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.
- B. Room Temperatures: Maintain not less than 40 deg F (4 deg C). For finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.
- C. Ventilation: Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 - 1. See PART 3 for finishing requirements.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC of 43-53 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90. Refer to Drawings for STC values.
- C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
 - 1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
 - 2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
 - 1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
 - 2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- E. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
 - 1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
- B. Manufacturers - Metal Framing, Connectors, and Accessories:
 - 1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
 - 2. Marino: www.marinoware.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- C. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa), or minimum code requirement, whichever is greater. Provide a minimum 20 gauge, Maximum 16" spacing between studs.
 - 1. Studs: "C" shaped with knurled or embossed faces.
 - 2. Runners: U shaped, sized to match studs.
 - 3. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
 - 4. Resilient Furring Channels: Single or double leg configuration; 1/2 inch (12 mm) channel depth.
- D. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 4000.

- E. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
 - 1. Products:
- F. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- G. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
 - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
 - 2. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
 - 3. Deflection and Firestop Track:
 - a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.
 - b. Products:
 - 1) FireTrak Corporation; Posi Klip.
 - 2) Metal-Lite, Inc.; The System.
 - 4. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet (3660 mm).

2.03 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

- A. General: Provide components of sizes indicated but not less than that required to comply with ASTM C 754 for conditions indicated.
- B. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
- C. Carrying Channels: Cold-rolled steel, 0.05980-inch-minimum thickness of base (uncoated) metal and 7/16-inch-wide flanges, 1-1/2 inch deep, 475 lb. per 1000 feet, rust-inhibitive paint finish. Use for primary suspension members where indicated.
- D. Steel Studs for Furring: ASTM C 645, with flange edges bent back 90 deg and doubled over to form 3/16-inch minimum lip (return), minimum thickness of base (uncoated) metal 0.0179 inch (nominal 25 ga.) unless otherwise indicated. Use for primary suspension members where indicated.
 - 1. Depth as indicated.
 - 2. Manufacturer's standard corrosion-resistant coating.
- E. Steel Rigid Furring Channels: ASTM C 645, hat shaped, and minimum thickness of base (uncoated) metal 0.0179 inch (nominal 25 ga.) unless otherwise indicated. Use for secondary suspension members where indicated.
 - 1. Depth - 7/8 inch and 1 1/2 inch.
 - 2. Protective Coating: Manufacturer's standard corrosion-resistant coating.
- F. Suspension System: Manufacturer's standard direct-hung grid suspension system complying with ASTM C 645 and composed of main beams and cross furring members that interlock to form a modular supporting network. Provide one of the following or Architect-approved substitute system:
 - 1. Chicago Metallic Corp. 630.
 - 2. National Rolling Mills, Inc. DFS Series.
 - 3. USG Interiors, Inc. Donn Rigid X Drywall Suspension System.
 - 4. Substitutions: Under provisions of Section 016000

2.04 BOARD MATERIALS

- A. General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end butt joints. Provide 5/8 inch thickness unless otherwise indicated.
- B. Manufacturers - Gypsum-Based Board:
 - 1. American Gypsum Company: www.americangypsum.com.

2. Georgia-Pacific Gypsum: www.gpgypsum.com.
 3. National Gypsum Company: www.nationalgypsum.com.
 4. USG Corporation: www.usg.com.
- C. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold resistant board is required at all locations.
 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch (16 mm).
 - b. Ceilings: 5/8 inch (16 mm).
 4. Mold Resistant Paper Faced Products:
 - a. American Gypsum Company; M-Bloc Type X.
 - b. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
 - c. National Gypsum Company; Gold Bond XP Gypsum Board.
 - d. USG Corporation; Sheetrock Brand Mold Tough Gypsum Panels..
- D. Impact Resistant Wallboard and Ceiling Board:
1. Application: At locations/wall types as indicated in Drawings. Provide up to 10'-0" AFF.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Type: Fire-resistance-rated Type X, UL or WH listed.
 4. Thickness: 5/8 inch (16 mm) at walls, 1/2 inch at ceilings.
 5. Edges: Tapered.
 6. Paper-Faced Products:
 - a. American Gypsum Company; M-Bloc Impact Resistance Type X.
 - b. National Gypsum Company; Gold Bond XP Hi-Impact Gypsum Board.
 - c. USG Corporation; Sheetrock Brand Mold Tough VHI Firecode X Panels 5/8 in. (15.9 mm): www.usg.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- E. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.
 2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 1/2 inch (12.7 mm).
 - b. Products:
 - 1) National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com/#sle.
 - 2) USG Corporation: www.usg.com.
 - 3) Or approved equal.
- F. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
 2. Thickness: 5/8 inch (16 mm), unless otherwise indicated.
 3. Edges: Tapered.
- G. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (610 mm) wide, beveled long edges, ends square cut.
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Products:

- a. American Gypsum Company; M-Bloc Shaft Liner.
- b. Georgia-Pacific Gypsum; ToughRock Shaftliner.
- c. National Gypsum Company; Gold Bond Fire-Shield Shaftliner XP.
- d. USG Corporation; Sheetrock Mold Tough Gypsum Liner Panels.

2.05 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- B. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 - 1. Typical Accessories: Provide corner beads, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:
 - a. Material: Formed sheet steel or zinc, or metal combined with paper, with sheet steel coated with zinc by hot-dip or electrolytic processes, or with aluminum.
 - b. Shapes as indicated by reference to designations in ASTM C 1047:
 - 1) Corner bead on outside corners, unless otherwise indicated.
 - 2) LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-bead for edge trim unless otherwise indicated.
 - 2. Aluminum Accessories: Where indicated, provide manufacturer's standard extruded aluminum accessories of profile indicated or referenced by manufacturer's product designations, with the following finish:
 - a. Class II Color Anodized Finish: AA-C12C22A32/A34, as selected from manufacturer's full range.
 - 1) Manufacturer: Subject to compliance with requirements, provide aluminum accessories of one of the following:
 - (a) Fry Reglet Corp.
 - (b) Gordon, Inc.
 - (c) MM Systems, Inc.
 - 2) One-piece control joint formed with V-shaped slot, with removable strip covering slot opening.
 - 3. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead and J-bead at exposed panel edges.
 - 4. Products:
 - a. Same manufacturer as framing materials.
- C. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
 - 1. Product: SpeedSkim manufactured by Freeman Products, Inc.
- D. Corrosion-resistant-coated steel drill screws of size and type recommended by board manufacturer for fastening cementitious backer units.
- E. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- F. Fry Reglet trim shapes as indicated on plans.
 - 1. Color and finish as selected from Manufacturer's full range of colors.
- G. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot grouting hollow metal door frames.
- H. Impaling Pins
 - 1. Steel pins with head not less than 2 inches (50 mm) in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend 3/4 of scheduled insulation. Adhesive shall be selected to be compatible with substrate.
- I. Sheet metal straps secured to studs to support impaling pins.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.
- B. Project Conditions: Verify that installation conditions specified in PART 1 - GENERAL have been achieved and can be maintained.
 - 1. Related Work: Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing for installation tolerances and other conditions affecting installation and performance of gypsum board assemblies.
 - 2. Acceptance: Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 3. Install studs at spacing required to meet performance requirements.
 - 4. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
 - 5. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Supplemental Framing: Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies and to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.
- C. Structural Isolation: Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
 - 1. Where building structure abuts ceiling perimeter or penetrates ceiling.
 - 2. Where partition framing and wall furring abut structure except at floor.
 - 3. Provide slip- or cushioned type joints as necessary to attain lateral support and avoid axial loading.
- D. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 - 1. Level ceiling system to a tolerance of 1/1200.
 - 2. Laterally brace entire suspension system.
 - 3. Install bracing as required at exterior locations to resist wind uplift.
- E. Studs: Space studs at 16 inches on center (at 400 mm on center), unless indicated otherwise.
 - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- F. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

3.03 WALL FRAMING

- A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.
 - 1. Space studs and furring members 16" o.c. unless otherwise indicated.
 - 2. Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.
 - 3. Install steel studs and furring in sizes and at spacing indicated but not less than that required to comply with maximum deflection and minimum loading requirements specified in PART 2 - PRODUCTS.
- B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing.
- C. Full Height Partitions: Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Cut studs 1/2 inch short of full height.

1. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
 2. Extend partitions to the underside of floor/roof slabs and decks or other continuous solid structural surfaces. Install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.
- D. Ceiling Height Partitions: Terminate partition framing at suspended ceilings where indicated. Extend jamb studs at door openings through suspended ceilings and attach to underside of structure above.
- E. Stud Framing:
1. Install steel studs vertically, engaged in floor and ceiling runners, and with open sides facing in the same direction and so that leading edges or ends of each gypsum board can be attached to open (unsupported) edges of stud flanges first. Position framing to provide support for all gypsum board edges (for vertical board application) or ends (for horizontal board application).
 2. For curved partitions install steel framing as follows:
 - a. Cut top and bottom runners through leg and web at 2-inch intervals for arc length. In cutting lengths of runners allow for uncut straight lengths of not less than 12 inches at ends of arcs.
 - b. Bend runners to uniform curve of radius indicated and locate straight lengths so they are tangent to arcs.
 - c. Support outside (cut) leg of runners by clinching a 1-inch-high by 0.0209-inch (25-gage)-thick sheet steel strip to inside of cut legs using metal lock fasteners.
 - d. Attach runners to structural elements at floor and ceiling with fasteners located 2 inches from ends and spaced 24 inches o.c.
 - e. Attach runners to suspended ceilings with toggle bolts or hollow wall anchors located 2 inches from ends and spaced 16 inches o.c. in between where attached to suspended ceilings.
 - f. Begin and end each arc with a stud and space intermediate studs equally along arcs at stud spacing recommended by gypsum board manufacturer for radiuses indicated. Attach studs to runners with 3/8-inch-long pan head framing screws. On straight lengths at ends of arcs, place studs 6 inches o.c. with last stud left free standing.
 3. Frame door openings with two 20 ga. studs at each jamb to comply with details indicated and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws to runner tracks and to jamb anchor clips on door frames. Install runner track section (for cripple studs) at head and secure to jamb studs.
 4. Frame openings other than door openings in same manner as required for door openings, except that jamb studs will not be required to be 20 ga. Install framing below sills of openings to match framing required above door heads.
- F. Wall Furring:
1. Space furring members 16 inches on centers unless otherwise indicated. Attach with 2-inch cut nails driven into masonry joints or with power-driven fasteners. Space fasteners 24 inches apart, staggered from flange to flange.
 2. Install furring members around openings, ducts, structural members, and other penetrations as needed to support gypsum board.
 3. Position furring members to provide support for all gypsum board edges (for vertical board application) or ends (for horizontal board application)
- G. Blocking: Install mechanically fastened steel channel blocking for support of:
1. Framed openings.
 2. Wall mounted cabinets.
 3. Plumbing fixtures.
 4. Toilet partitions.
 5. Toilet accessories.

6. Wall mounted door hardware.
7. Fire Extinguisher Cabinets.
8. Other items as required.

3.04 INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

- A. General: At the option of the Installer, any of the following framing methods may be used.
 1. Main runners (carrying channels or metal studs) suspended from overhead structure and cross furring (rigid furring channels).
 2. Steel studs, suspended or attached to adjoining wall/partition structure. Unless otherwise indicated or required, use 3-5/8" studs, maximum 24" o.c., for spans up to 8'-0".
 3. Proprietary suspension system.
- B. Coordination: Coordinate layout and installation of ceiling suspension system with other work above, supported by and penetrating ceilings.
- C. Hangers: Suspend ceiling hangers from building 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 structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
 3. Secure wire hangers 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 them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 4. Do not connect or suspend steel framing from ducts, pipes or conduit.
- D. Installation Tolerances: Install steel framing components for suspended ceilings so that cross furring members or grid suspension members are level to within 1/8 inch in 12 ft. as measured both lengthwise on each member and transversely between parallel members.
- E. Suspended Framing:
 1. Provide hangers not closer than 6" to ends of primary members.
 2. Locate both primary and secondary members not more than 6" from walls and partitions which interrupt ceilings.
 3. Provide 1" clearance between ends of framing members and abutting walls and partitions.
 4. Sway-brace suspended steel framing with hangers used for support.
- F. Suspended Steel Framing: Install components in sizes and at spacing indicated but not less than that required by referenced steel framing installation standard.
 1. Wire Hangers: 0.1620 inch diameter (8 gage), 4 ft. on center maximum.
 2. Primary Members (main runners): Carrying channels or steel studs, 4 feet on center, maximum.
 3. Secondary members (cross furring): Hat-shaped channels, 24 inches on center, maximum.
 4. Wire-tie or clip furring members to main runners and to other structural supports as indicated.
- G. Proprietary Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross furring members to each other and butt cut to fit into wall track. Comply with system manufacturer's instructions.

3.05 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

- B. Where double-stud walls, or single-side gypsum board walls occur, friction fit insulation between studs and secure impaling pins in accordance with the manufacturer's instructions.
- C. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.06 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- E. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- F. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

3.07 APPLYING AND FINISHING GYPSUM BOARD

- A. General Standards: Install and finish gypsum panels to comply with ASTM C 840 and gypsum board manufacturer's recommendations.
 - 1. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. 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.
 - 2. Locate either edge or end joints over supports. Position boards so that tapered edges abut tapered edges and mill-cut or field-cut ends abut mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends.
 - 3. Locate exposed end-butt joints as far from centers of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.
 - 4. Fit gypsum board neatly around ducts, pipes, conduits, and other penetrating items, and around openings for electrical devices, fixtures, accessories and similar recessed items.
 - 5. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
 - 6. Form control joints and expansion joints at locations indicated, with space between edges of boards, prepared to receive trim accessories.
 - 7. Where gypsum board intersects beams, joists, columns and other structural components, cut gypsum board to fit profile of component and allow 1/4 to 1/2 inch wide joint for sealant.
- B. Ceilings: Install ceiling boards across supports in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24 inches.
- C. Walls and Partitions: Install wall/partition boards with 1/4-inch gap at floor and in manner which avoids end-butt joints entirely where possible.
 - 1. At walls more than 12 feet high, install boards horizontally with end joints staggered over studs.
 - 2. Stagger gypsum board joints over different studs on opposite faces of partitions.
 - 3. Cover both faces of partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls.
 - 4. Attach gypsum board to steel studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flange first.

5. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32 inches wide. Apply spot grout at each jamb anchor clip and immediately insert gypsum panel into frames.
6. Isolate perimeter of non-load-bearing partitions at structural abutments. Provide 1/4 inch to 1/2 inch space, and where exposed in the completed construction, trim edge with edge trim. Seal joints with acoustical sealant, except at fire-rated partitions joints shall be fire-stopped as specified in Section 078400.

3.08 GYPSUM BOARD APPLICATION METHODS

- A. General: Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.
- B. Single Layer Application: Install gypsum board as follows:
 1. On ceilings, apply gypsum board prior to wall/partition board application to the greatest extent possible and at right angles to supports, unless otherwise indicated. Provide lengths that will avoid or minimize end joints.
 2. On partitions/walls, apply gypsum board horizontally (perpendicular to supports), unless parallel application is required for fire-resistive-rated assemblies. Use maximum length panels to avoid or minimize end joints. Stagger joints on opposite sides of partitions.
 3. On furring members, apply gypsum board vertically (parallel to supports) with no end joints. Locate edge joints over furring members.
- C. Single Layer Fastening Methods: Apply gypsum panels to supports as follows:
 1. Fasten to steel framing with screws.
 2. Fasten to wood supports with screws or double nailing.
- D. Sound Attenuation: Install insulation after framing is complete and piping, conduits, ducts and other penetrating items are complete and tested. Install insulation to form a continuous sound barrier the full height and width of the partition.
 1. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
 2. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - a. Place continuous bead at perimeter of each layer of gypsum board.
 - b. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.
- E. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners. Provide trim as follows.
 1. Install corner beads at all external corners.
 2. Install edge trim where edge of gypsum panels would otherwise be exposed and where gypsum panels are tightly abutted to other construction. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.
 3. Install aluminum edge trim and other accessories where indicated.
- F. Control Joints: Install control joints at locations indicated, and where not indicated in locations approved by Architect for visual effect according to the following requirements:
 1. In ceilings: Not more than 30 feet apart in any direction (50 feet if perimeter relief exists), and wherever support framing or furring changes direction.
 2. In walls/partitions: Not more than 30 feet apart, and wherever a control joint occurs in an exterior wall which services as a base for gypsum board finish. Wall or partition height door frames may be considered control joints.

3.09 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads and surface defects; and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated.

1. Pre-fill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
 2. Apply joint tape over gypsum board joints and to face flanges of aluminum and other trim accessories as recommended by trim accessory manufacturer to prevent cracks from developing in joint compound at flange edges.
- B. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214, or as specified in the drawings. All new construction painted exposed gypsum board surfaces to be Level 5 finish, unless otherwise indicated. All gypsum board surfaces to receive full wall graphics or specialty paint features shall be Level 5 finish.
1. Level 0 for temporary construction or where indicated in drawings.
 - a. No taping, finishing or accessories required.
 2. Level 1 for ceiling plenum areas, concealed areas, or where indicated in drawings, unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies, apply joint compound specified for embedding coat.
 - a. Embedding and First Coat: Ready-mixed, drying-type, all-purpose or taping compound.
 - 1) Tool marks and ridges acceptable. Surface free of excess joint compound.
 3. Level 2 for mechanical & electrical areas, behind cabinetry, backing board to receive a tile finish and where indicated in drawings.
 - a. Embedding and First Coat: Ready-mixed, drying-type, all-purpose or taping compound. Whip compound with joint knife leaving a thin coat of compound over tape.
 - 1) Surface shall be free of excess joint compound. Tool marks and ridges acceptable. Joint compound applied over body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the condition of this level.
 4. Level 3 walls to receive textured wall finish in locations indicated in drawings.
 - a. Embedding and First Coat: Ready-mixed, drying-type, all-purpose or taping compound.
 - 1) Fill (Second) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
 - 2) Accessories and fasteners shall be covered by two separate coats of joint compound.
 - 3) Joint compound shall be smooth and free of tool marks and ridges.
 - 4) Prepare surface to be coated with drywall primer prior to the application of final finishes.
 5. Level 4 gypsum board finish, embed tape in finishing compound plus two separate coats applied over joints, angles, fastener heads, and trim accessories using the following joint compounds (not including pre-fill), and sand between coats and after last coat:
 - a. Embedding and First Coat: Ready-mixed, drying-type, all-purpose or taping compound.
 - 1) Fill (Second) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
 - (a) Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
 - (b) Accessories and fasteners shall be covered by two separate coats of joint compound.
 - (c) Joint compound shall be smooth and free of tool marks and ridges.
 - (d) Prepare surface to be coated with drywall primer prior to the application of final finishes.
 - (e) Prepare and submit a 24"x24" review sample for Architect's approval as per following specification prior to commencement of finishing of this level type.
 - (f) In lieu of finish listed above, contractor has the option where Level 4 finish is indicated, spray apply high build drywall surfacer (listed in 2.5 E) over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

6. Level 5 for gypsum board surfaces indicated to receive gloss and semi-gloss paints, enamel paints, non-textured walls to receive flat paints, all gypsum board surfaces to receive full wall graphics or specialty paint features and where indicated in drawings.
 - a. Where Level 5 finish with light texture gypsum board finish is indicated, provide finish specified for level 4 plus a thin, uniform skim coat of joint compound over entire surface. Use a joint compound specified for the finish (third coat) or a product specially formulated for this purpose and acceptable to gypsum board manufacturer.
 - b. Produce surfaces free of tool marks and ridges ready for decoration of type indicated. Refer to ASTM C 840.
 - c. In lieu of finish listed above, contractor has the option where Level 5 finish is indicated, spray apply high build drywall surfacer (listed in 2.5 E) over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.10 CLEANING AND PROTECTION

- A. Cleaning: Promptly remove any residual joint compound from adjacent surfaces.
- B. Protection: Provide final protection and maintain conditions that ensure gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

3.11 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

SECTION 09 3000 TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Stone thresholds.
- D. Ceramic accessories.
- E. Integral tile floor drains and waterproofing membrane
- F. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136.1 - Specifications for the Installation of Ceramic Tile; 2020.
- B. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2019.
- C. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2014 (Reaffirmed 2019).
- D. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.
- E. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, water proof membrane, and accessories. Include instructions for using grouts, water proof membrane, and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Tile: 1 percent of each size, color, and surface finish combination, but not less than 10 s.f. of each type.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 MOCK-UPS

- A. See Section for general requirements for mock-up.
- B. Construct tile mock-up where required by Architect, incorporating all components specified for the location.
 - 1. Minimum size of mock-ups is 10' X 10", required for walls & floors.
 - 2. Approved mock-up may remain as part of work.
 - 3. Demolish mock-up when directed by Architect, and remove debris from the site.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

- A. Basis of Design Products (**TL-1, TL-2, TL-3, T-4**): Subject to compliance with requirements, provide the products listed in the Drawing Finish Key. Specific tile products are identified in the drawings to establish the color, design intent, and required standard of quality. It is not the intent to preclude the use of other prior approved, acceptable manufacturers.
- B. Substitutions: Subject to compliance with requirements, products of the following manufacturers may be substituted for prior approval upon matching Architect's control sample in color, texture, construction and performance characteristics. Final approval to be determined by Architect.
- C. Ceramic Wall and Mosaic Tile: ANSI A 137.1, non-vitreous body (absorption less than 0.5 percent), thickness varies by product, cushion edges, factory mounted (mosaic).
 - 1. Trim Shapes: As required of same type, size, thickness and material as tile.
- D. Porcelain Tile: A ceramic tile or paver tile that is generally made by the dust-pressed method of a composition resulting in a tile that is dense, impervious, fine grained, and smooth with sharply formed face.
- E. Glass Tile: A glass tile that is suitable for interior use and which is usually non-vitreous and is not required nor expected to withstand excessive impact or to be subject to freezing and thawing conditions.
- F. Wall Tile: A glazed tile with a body that is suitable for interior use and which is usually non-vitreous and is not required nor expected to withstand excessive impact or be subject to freezing and thawing conditions.
- G. Marble Thresholds: Provide marble thresholds complying with ASTM C 503 requirements for exterior use and with a minimum abrasive-hardness value of 10 per ASTM C 241.
 - 1. Fabricate thresholds to heights indicated, but not more than 1/2 inch above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2.

2.02 WATERPROOFING MEMBRANE:

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is acceptable to authorities having jurisdiction for use as shower pan waterproofing, as selected from one of the following available options. Include primer, pre-fabricated corners, seaming cement, detail tape sealant, integrated drain and other standard accessory products required for application provided by membrane manufacturer. At Showers use complete shower system as manufactured by Schluter. In restrooms install Schluter KERDI waterproofing membrane on entire floor of restroom and up wall minimum 1", install waterproofing membrane into integral floor drain bonding flange & floor drain.

- B. Material Description: 0.008" (8 mil) thick, polyethylene membrane, with polypropylene fleece laminated on both sides, which meet or exceed the requirements of the "American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation A118.10", and is listed by cUPC, and is evaluated by ICC-ES (see Report No. ESR-2467).
- C. Manufacturer:
 - 1. Schluter-KERDI, as manufactured by Schluter Systems.
- D. Accessories:
 - 1. Waterproofing seaming membrane - Schluter KERDI-BAND Seams and Corners, 0.004" (4 mil) thick.
 - 2. Mixing Valve seals and pipe seals.
 - 3. Floor drain: Schluter 4"x4" KERDI-Drain with integral bonding flange and no hub fitting, coordinate bonding flange with plumbing PVC or Stainless steel as required.(size and shape as indicated in Drawings).
 - a. Drain grate pattern and finish to be selected by Architect from manufacturer's full range.
 - 4. Prefabricated, sloped tiled shower tray base.

2.03 CRACK ISOLATION MEMBRANE UNDERLAYMENTS

- A. General: Manufacturer's standard product that complies with ANSI A118.12 as selected from one of the following options. Include primer, pre-fabricated corners, seaming cement, detail tape, sealant, and other standard accessory products required for application provided by membrane manufacturer.
- B. Fluid-Applied Crack Isolation Membrane Underlayment:
 - 1. Description: Manufacturer's proprietary system consisting of liquid applied component and synthetic fabric sheet reinforcement.
 - 2. Manufacturers and Products:
 - a. Custom Building Products: RedGard Waterproofing and Crack Prevention Membrane.
 - b. Laticrete International Inc.; Laticrete 9235 Waterproof Membrane.
 - c. Laticrete International Inc.; Blue 92 Anti-Fracture Membrane.
 - d. Mapei Corp; Mapelastic HPG.
- C. Fluid-Applied Waterproofing and Crack Isolation Membrane to be installed on ALL walls with tile in restrooms. Membrane to be installed full height in showers, as part of shower system indicated elsewhere in this Section
- D. Faced Chlorinated Polyethylene (CPE) Crack Isolation Membrane Underlayment:
 - 1. Description: Non-plasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric; minimum 0.030 in nominal thickness.
 - 2. Manufacturer and Product: The Noble Company; NobleSeal CIS.

2.04 SETTING MATERIALS

- A. Manufacturers:
 - 1. Custom Building Products.
 - 2. MAPEI Corporation.
 - 3. Summitville Tiles, Inc.
- B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:
 - 1. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.
 - a. For wall applications, provide non-sagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.
- C. Medium Thin-set Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for thin-set application.

1. Basis of Design Product: Subject to compliance with requirements, provide Custom Building Products MegaLite Non-Sag Rapid Set Mortar or a comparable product from one of the following:
 - a. MAPEI Corporation; Ultraflex LFT.
 - b. Summitville Tiles, Inc.; S-1200 MP Premium Medium Bed Mortar.
 2. Application: Large format tile installations. Refer to the Drawing Finish Legend for tile sizes.
- D. For wall applications, provide mortar that complies with requirements for non-sagging mortar in addition to the other requirements in ANSI A118.4.

2.05 GROUT MATERIALS

- A. Manufacturers:
1. Custom Building Products
 2. MAPEI Corporation
 3. Summitville Tiles, Inc.
- B. Water-Cleanable Epoxy Grout: ANSI A118.3.
1. 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.

2.06 ELASTOMERIC SEALANTS

- A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants".
1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - a. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

2.07 CEMENTITIOUS BACKER UNITS

- A. Refer to Section 09 2116 "Gypsum Board Assemblies" for cementitious tile backer board to be provided by that Section.

2.08 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. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
 2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- C. 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.
- D. Edge Strips (Where Indicated): Angle, radius or L-shape, height to match tile and setting-bed thickness, metallic or PVC or neoprene base, designed specifically for flooring applications.
1. Basis of Design Product: Schluter Systems, LP transitions and reducers or a comparable approved product of one of the following:
 - a. Blanke Corporation
 - b. Ceramic Tool Company, Inc.

2. Tile to Carpet: Schluter - Model as indicated on drawings.
 3. Tile to Tile, Edge Termination or Transitions As Indicated: Schluter - Model as indicated on drawings.
 4. Tile to Wood Flooring: Schluter - Model as indicated on drawings.
 5. Tile Floor to Wall Transition: Schluter - Model as indicated on drawings.
 6. Tile Expansion Joints: Schluter - Model as indicated on drawings.
- E. Waterproofing membrane, crack isolation membrane underlayment, shower systems, and floor drain assembly, install as per manufacturer's written requirements.

2.09 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

3.01 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 installed tile.
 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 thin-set 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.

3.02 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set 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, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.03 WATERPROOF MEMBRANE UNDERLAYMENT INSTALLATION

- A. Installation Quality Standard: ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- B. General Requirements:
 - 1. If required by manufacturer, prime concrete substrate.
 - 2. Install to produce a continuous waterproof membrane of uniform thickness bonded securely to substrate, without wrinkles, bubbles, buckles or kinks.
 - 3. For sheets, overlap and seal seams.
 - 4. Turn membrane up wall at locations where tile is scheduled for wall or base.
 - 5. Roll installed sheet if required by manufacturer.
 - 6. Install tile after waterproofing has cured and been testing determined it is watertight.

3.04 CRACK ISOLATION MEMBRANE UNDERLAYMENT INSTALLATION

- A. General Requirements:
 - 1. If required by manufacturer, prime concrete substrate.
 - 2. Install to produce a continuous crack isolation membrane of uniform thickness bonded securely to substrate, without wrinkles, bubbles, buckles, or kinks.
 - 3. For sheets, overlap and seal seams.
 - 4. For liquid applied products, brush or roll liquid uniformly over area in number of coats required and install reinforcing fabric.
 - 5. Roll installed sheet if required by manufacturer.
 - 6. After installation of tile, install floor joint sealant in tile joints recommended by manufacturer to coordinate with membrane strips.

3.05 TILE INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA 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 TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors composed of tiles 8 by 8 inches or larger.
- B. Extend tile work into recesses and under or behind millwork, casework, equipment and fixtures to form complete floor and/or wall 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. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. 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 following joint widths:
 - 1. Porcelain Paver Tile: 1/8 inch or according to manufacturer's recommendation.

2. Porcelain Mosaic Tile: 1/16 inch or according to manufacturer's recommendation.
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. 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.
 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealers".
- I. Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- J. Grout tile to comply with requirements of the following tile installation standards:
 1. For epoxy tile grouts, comply with ANSI A108.6.

3.06 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with The Tile Council of North America Handbook Method F113, dry-set or latex-Portland cement bond coat, with epoxy grout, unless otherwise indicated.
 1. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F115.
- B. Field-Applied Temporary Protective Tile Coating: Apply a continuous film to protect tile surfaces from adhesion of grout.
- C. Back Buttering: Produce 100 percent mortar coverage on tile backs to comply with applicable special requirements for back buttering in ANSI A108 Series tile installation standards in the following locations:
 1. Floors in wet areas.
 2. Floors composed of 8-by-8-inch tile or larger.
 3. Floors composed of rib-backed tiles.
- D. Blending: For tile with color variations, install blended tiles to produce color variations that match approved Samples.
- E. Extend tile work into recesses and under or behind millwork, casework, equipment and fixtures to produce a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- F. Accurately form intersections and returns. Cut and drill tile without marring visible surfaces. Grind cut edges of tile abutting trim, finish, or built-in items to produce straight aligned joints. Fit tile to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- G. Jointing Pattern: Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths.
 1. Lay tile in grid pattern.
- H. Joint Widths: Produce uniform joint widths as follows:
 1. Per manufacturer's recommendations
- I. Expansion Joints: Form expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 1. Locate joints in tile surfaces directly above joints in concrete substrates, and as recommended by tile manufacturer and or TCA for area covered.
 2. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."

- J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile, unless otherwise indicated.
- K. Stone Thresholds: Install stone thresholds set in same type of setting bed as abutting field tile, unless otherwise indicated.
 - 1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent non-tile floor finish.

3.07 INSTALLATION - WALL TILE

- A. Over cementitious backer units install in accordance with TCNA (HB) Method W223, organic adhesive.
- B. Field-Applied Temporary Protective Tile Coating: Apply a continuous film to protect tile surfaces from adhesion of grout.
- C. Back Buttering: Produce 100 percent mortar coverage on tile backs to comply with applicable special requirements for back buttering in ANSI A108 Series tile installation standards in the following locations:
 - 1. Wall installations composed of 8-by-8-inch tile or larger.
- D. Blending: For tile with color variations, install blended tiles to produce color variations that match approved Samples.
- E. Extend tile work into recesses and under or behind millwork, casework, equipment and fixtures to produce a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- F. Accurately form intersections and returns. Cut and drill tile without marring visible surfaces. Grind cut edges of tile abutting trim, finish, or built-in items to produce straight aligned joints. Fit tile to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- G. Jointing Pattern: Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths.
 - 1. Lay tile in grid pattern.
- H. Joint Widths: Produce uniform joint widths as follows:
 - 1. Wall Tile: Per manufacturer's recommendations
- I. Refer to TCA's "Handbook for Ceramic Tile Installation" and to ANSI A108 Series of tile installation standards for data on expansion joints. Both the "Handbook" and standards require joints to be shown on Drawings. Descriptive specifications are not an adequate substitute for showing joints on Drawings.
- J. Expansion Joints: Form expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
 - 2. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."

3.08 CLEANING AND PROTECTION

- A. 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. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. 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.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven (7) days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.09 FLOOR TILE INSTALLATION SCHEDULE

- A. Interior slab-on-grade floor installation on a waterproof membrane over concrete; thin-set Latex-Portland cement mortar; TCA F113 and ANSI A108.5 and ANSI A108.17 (where applicable).
 1. Tile Type: As indicated in the Drawing "FINISH KEY".
 2. Thin-Set Mortar: Latex-Portland cement mortar.
 3. Medium Thin-set Mortar for Large Format Tiles: Mortar indicated or manufacturer's recommended mortar.
 4. Location: For all slab-on-grade locations except as otherwise noted.
- B. Interior above-grade, structural floor installation on a waterproof membrane over concrete; thin-set Latex-Portland cement mortar; TCA F122 and ANSI A108.5 and ANSI A108.13.
 1. Tile Type: As indicated in the Drawing "FINISH KEY".
 2. Thin-Set Mortar: Latex-Portland cement mortar.
 3. Medium Thin-Set Mortar for Large Format Tiles: Refer to installation method F128 below.
 4. Location: Elevated structural floor concrete slabs.

3.10 WALL TILE INSTALLATION SCHEDULE

- A. Tile Installation: Interior wall installation over backer board; thin-set mortar; W244C (wet conditions) with cementitious backer board and waterproof membrane; W243 (dry conditions) with Type X gypsum board; ANSI A108.5.
 1. Tile Type: As indicated in the Drawing "FINISH KEY".
 2. Thin-Set Mortar: Latex-Portland cement mortar or according to manufacturer's recommendation.
 3. Medium Thin-Set Mortar for Large Format Tiles: Mortar indicated or manufacturer's recommended mortar.

**SECTION 09 5100
ACOUSTICAL CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.
- C. Section 07 2100 - Thermal Insulation: Acoustical insulation.

1.02 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
- C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.03 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data: Provide data on suspension system components.
- C. Samples: Submit two samples 6 by 6 inch (152 by 152 mm) minimum in size illustrating material and finish of acoustical units.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 2 percent of total installed for each tile and grid type.

1.04 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Fire-Performance: Provide acoustical panels with surface burning characteristics specified below, based on ASTM E 84 tests performed by UL or other independent agency acceptable to authorities having jurisdiction. Identify packaged products with approval markings of test agency.
 - 1. Flame Spread: 25 or less.
 - 2. Smoke Developed: 50 or less.
- D. Coordination: Coordinate layout and installation of ceiling system with related construction.

1.05 FIELD CONDITIONS

- A. Installation Conditions: Do not install acoustical ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and temperature and humidity will be continuously maintained near levels intended for final occupancy.
- B. Fireproofing: All fireproofing which is removed shall be replaced. All penetrations of fireproofing shall be patched or sealed to restore the required fire resistance.
- C. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage:
 - 1. Deliver ceiling components to project site in original packages and protect during storage against damage.
 - 2. Before installing acoustical ceiling units, permit them to reach stabilized temperature and humidity of space where they will be installed.
- B. Handling: Handle ceiling components to avoid chipping or damaging them.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

- A. Acceptable Manufacturers: Acoustical ceiling systems are based on the products of manufacturers listed below and as indicated in the Drawing Finish Key.
 - 1. Armstrong Commercial Ceilings
- B. Substitutions: Subject to compliance with requirements, products of the following manufacturers may be substituted for prior approval upon matching Architect's control sample in color, texture, construction and performance characteristics. Final approval to be determined by Architect.
 - 1. USG Ceiling Systems, Inc.
 - 2. Armstrong Commercial Ceilings
 - 3. CertainTeed
- C. Suspension Systems for Acoustical Ceiling Systems:
 - 1. Basis of Design (AC-1, AC-2): Armstrong Commercial Ceilings - Prelude XL Exposed Tee - 15/16", White.
 - 2. USG Ceiling Systems, Inc.
- D. Ceiling Tiles for Acoustical Ceiling Systems:
 - 1. **AC-1:**
 - a. Basis of Design: Armstrong Commercial Ceilings - Ultima High-NRC Square Lay-in Panel 2080, 2' x 2' x 1", Square Lay-In, White.
 - 1) NRC: 0.80
 - 2) CAC: 35
 - 3) Class A Fire Rating
 - 4) Light Reflectance: 0.85
 - b. USG Ceiling Systems, Inc.
 - 2. **AC-2:**
 - a. Basis of Design: Armstrong Commercial Ceilings - Ultima High-NRC Square Lay-in Panel 1435, 2' x 6' x 1", Square Lay-In, White.
 - 1) NRC: 0.80
 - 2) CAC: 35
 - 3) Class A Fire Rating
 - 4) Light Reflectance: 0.85
 - b. USG Ceiling Systems, Inc.

2.02 ACOUSTICAL CEILING UNITS, GENERAL

- A. Standard for Acoustical Ceiling Units: Provide manufacturers' standard units that comply with ASTM E 1264 classifications specified.
- B. Mounting Method for Measuring NRC: Type E-400 (plenum mounting in which face of test specimen is 15-3/4 inches [400 mm] away from the test surface) per ASTM E 795.
- C. Colors and Patterns: Provide products to match appearance characteristics indicated.

2.03 METAL SUSPENSION SYSTEMS, GENERAL

- A. Standard for Metal Suspension Systems: Provide manufacturer's standard metal suspension systems that comply with ASTM C 635 requirements as specified.

- B. Finishes and Colors: Provide manufacturer's full range of factory-applied finish.
- C. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- D. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
 - 1. Gage: Provide wire sized so that stress at 3 times hanger design load (ASTM C 635, Table 1, Direct-Hung) will be less than yield stress of wire, but not less than 0.106-inch diameter (12 gage).
- E. Edge Moldings and Trim: Manufacturer's standard moldings for edges and penetrations, of types and profiles indicated.
 - 1. Material: Roll-formed, hemmed-edge, galvanized steel.
 - 2. Finish: Provide manufacturer's full range of factory-applied finish to match system components.

2.04 RELATED MATERIALS

- A. Concealed Acoustical Sealant: Nondrying, non-hardening, non-skinning, non-staining, non-bleeding, gunnable synthetic rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission, Pecora "BA-98", Tremco "Acoustical Sealant", or similar.

2.05 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

2.06 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Perimeter Moldings: Same material and finish as grid.
 - 1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid. Basis of Design: 4-inch AXIOM Trim.
- C. Expansion Joints: Provide assembly per Manufacturer's Recommendations.
 - 1. Basis of Design to include Wall Molding (Back to Back with Pop Rivet suspended with hanger wire and installed centered between 1" gap at tile and grid.
- D. Acoustical Sealant for Perimeter Moldings: Specified in Section 07 9200.
- E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.
- C. Examine ambient conditions, substrates and construction to which ceiling system attaches or abuts, for compliance with requirements specified in this and other sections that affect installation and anchorage of ceiling system. Do not proceed with ceiling installation until unsatisfactory conditions have been corrected.
- D. Layout: Generally, measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half-size units at borders, and comply with reflected ceiling plans.
- E. If drawing dictates specific layout or work point, comply with Drawings.
- F. Coordination: Furnish layouts for preset inserts, clips, and other devices for ceiling hangers which are installed as work of other Sections. Supply devices for installation well in advance of time needed.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C 636/C 636M, ASTM E 580/E 580M, ASTM C 636/C 636M, ASTM E 580/E 580M, ASTM C 636/C 636M, and ASTM E 580/E 580M and as supplemented in this section.
- B. Arrangement: Arrange acoustical units and orient ceiling suspension grid shown by reflected ceiling plans.
- C. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- D. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size. Unless otherwise indicated.
- E. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- F. Suspend ceiling hangers from structural components only, not from conduits, pipes, ducts, and other non-structural items. Do not attach hangers to metal deck or permanent metal forms.
- G. Install hangers plumb and free from contact with ducts, pipes, conduits or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counters playing, or other effective means.
- H. Space hangers not more than 4'-0" o.c. along each supported member unless otherwise shown, and provide hangers not more than 8 inches from ends of each member.
- I. Where ducts and other construction interfere with the location of hangers, install supplemental suspension members and hangers in form of trapezes or equivalent devices to support ceiling loads within performance limits established by referenced standards.
- J. Secure wire hangers by looping and wire-tying, either directly to in-place construction or to inserts, eye-screws, or other secure, appropriate devices, and so that attachments will not fail due to age, corrosion, or elevated temperatures.
- K. Assemble and support suspension grid in accordance with grid manufacturer's instructions. Support grid independently of edge moldings; do not use edge moldings for support.
- L. Level suspension system to tolerance of 1/8" in 12'-0".
- M. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- N. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- O. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- P. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.
- Q. Do not eccentrically load system or induce rotation of runners.
- R. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Screw-attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8" inch in 12' 0". Miter corners accurately and connect securely.
 - 2. Install in bed of acoustical sealant.
 - 3. Use longest practical lengths.
 - 4. Overlap and rivet corners.
- S. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch (25 mm) movement. Maintain visual closure.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.
 - 3. Double cut and field paint exposed reveal edges.
- G. Where round obstructions occur, provide preformed closures to match perimeter molding.

3.04 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

**SECTION 09 5426
SUSPENDED WOOD CEILINGS**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section

1.02 SUMMARY

- A. Section Includes
 - 1. Linear Veneered Plank Panel Ceiling System
 - 2. Wire hangers, fasteners, main runners, wall angle moldings and accessories.

1.03 RELATED SECTIONS:

- A. Section 09 5100 - Acoustical Ceilings
- B. Division 23 - HVAC
- C. Division 26 - Electrical

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
 - 2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
 - 3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
 - 4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
 - 6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
 - 7. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
 - 8. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
 - 9. ASTM E 1264 Classification for Acoustical Ceiling Products
- B. Hardwood Plywood & Veneer Association (HPVA)
- C. International Building Code
- D. ASHRAE Standard 62.1-2004 Ventilation for Acceptable Indoor Air Quality
- E. NFPA 70 National Electrical Code
- F. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures
- G. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components
- H. International Code Council-Evaluation Services Report - Seismic Engineer Report
 - 1. ESR 1308 - Armstrong T-Bar or Dimensional Suspension
- I. California Air Resources Board (CARB) compliant
- J. LEED - Leadership in Energy and Environmental Design is a set of rating systems for the design, construction, operation, and maintenance of green buildings

1.05 SUBMITTALS

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- A. Product Data: Submit manufacturer's technical data for each type of ceiling unit and suspension system required.
- B. Installation Instructions: Submit manufacturer's installation instructions as referenced in Part 3, Installation.
- C. Samples: Minimum 3-1/2 inch or 5-1/2 inch samples of specified panel; 8 inch long samples of exposed wall molding and suspension system, including main runner.
- D. Samples: Wood beam sample demonstrating construction, wood grain, and color.
- E. Shop Drawings: Illustrating the layout and details of the ceilings. Show locations of items that are to be coordinated with, or supported by the ceilings.
- F. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- G. All products not conforming to manufacturer's current published values must be removed and dispose. Replace with complying product at the expense of the Contractor performing the work.

1.06 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide ceiling panel units and grid components by a single manufacturer.
- B. Fire Performance Characteristics: Identify ceiling components with appropriate markings of applicable testing and inspecting organization.
 - 1. Surface Burning Characteristics: As follows, tested by HPVA (Hardwood Plywood and Veneer Association) under the test standard ASTM E-84 tunnel test and complying with ASTM E 1264 for Class A products.
 - a. Flame Spread: 25 or less
 - b. Smoke Developed: 50 or less
- C. Woodworking Standards: Manufacturer must comply with specified provisions of Architectural Woodworking Institute quality standards.
- D. Woodworks Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.
- E. Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, wet work i.e. gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.
- F. Wood Beam Ceiling System components shall be kiln dried to 10%. Cracking, checking and warpage of members will not be acceptable.
- G. Wood Beam Ceiling System components shall be installed true and plumb to within manufacturing tolerance of 1/8" within 8' of length.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Wood Beam Ceiling Systems:
 - 1. Material must be stored and installed only in secured ambient environment (humidity min. 35% - max. 55%, temperature not to exceed 86 deg.)
 - 2. Windows, doors and all wet-work must be completed before unpacking and installation. Handle carefully to avoid damage.
- B. Linear Veneered Plank Panel Ceiling Systems:
 - 1. Ceiling components should be stored in a dry interior location and shall remain in cartons or crates prior to installation to avoid damage. The cartons should be stored in a flat, horizontal position. The protectors between panels should not be removed until installation. Proper care must be taken when handling to avoid damage and soiling. Do

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not store in unconditioned spaces with humidity greater than 55% or lower than 25% RH and temperatures lower than 50°F or greater than 86°F. Panels must not be exposed to extreme temperatures, for example, close to a heating source or near a window where there is direct sunlight.

1.08 PROJECT CONDITIONS

- A. Wood Beam Ceiling Systems:
 - 1. Install conditions for the area should remain for the proper occupied conditions of humidity and temperature (humidity min. 25% - max. 55%, temperature not to exceed 86 degrees from time of installation until turned over to the Owner. At that time, Owner shall become responsible for maintaining these conditions.
- B. Linear Veneered Plank Panel Ceiling Systems:
 - 1. Ceiling panels and veneer-wrapped trim should be permitted to reach room temperature and have stabilized moisture content for a minimum of 72 hours before installation. (Remove plastic wrap to allow panels to acclimatize.) They should not, however, be installed in spaces where the temperature or humidity conditions vary greatly from the temperatures and conditions that will be normal in the occupied space.
 - 2. Proper design for both supply air and return air, maintenance of the HVAC filters, and building interior space are essential to minimize soiling. Before starting the HVAC system, make sure air supply is properly filtered and the building interior is free of construction dust.
 - 3. Ceiling panels are interior finish products that are designed for installation to be carried out in temperature conditions between 50°F (10°C) and 86°F (30°C), in spaces where the building is enclosed and HVAC systems are functioning and will be in continuous operation. Relative humidity shall not fall below 25% or exceed 55%. There shall be proper ventilation of the plenum in high moisture areas.
 - 4. All plastering, concrete, or any other wet work shall be completely dry. All windows and doors shall be in place. The heating, ventilation, and air-conditioning system should be installed and operable where necessary to maintain proper temperature before, during and after installation of the WoodWorks panels.

1.09 WARRANTY

- A. Wood Beam Ceiling System:
 - 1. Contractor shall warranty the Wood Beam System against manufacturer's defects up to one year. Changes in finish or dimensions due to ultra violet light, excessive temperature or humidity conditions and/or abuse of any kind shall void any warranties from the manufacturer.
 - 2. Contractor shall warranty all work from date of substantial completion.
- B. Linear Veneered Plank Panel Ceiling Systems:
 - 1. Contractor shall warranty the Linear Veneered Plank Panel Ceiling System against manufacturer's and workmanship defects for one year from date of substantial completion.

1.10 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
 - 1. Ceiling Units: Furnish quantity of full-size units equal to 5.0 percent of amount installed.
 - 2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Ceiling Panels:
 - 1. Armstrong World Industries, Inc.

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2.02 LINEAR VENEERED PLANK PANEL CEILING SYSTEM

- A. Manufacturers (**WCS-1**):
 - 1. Basis of Design: Armstrong, Product: Woodworks Linear Veneered Open Panels: www.armstrongceilings.com
 - 2. Or Prior Approved Equal.
- B. Tapered Planks
- C. Material: FSC certified fire-retardant particle board with face-cut veneers.
- D. Panel Size: 6" (5.25"W) Plank, 24" x 96" x 3/4"
- E. Weight: 2.75 lf/sf.
- F. Veneer Color: Constants Walnut
- G. Factory Edge Banding
 - 1. Provide in matching veneer color. Banding comes in 300' x 3/4" roll.
- H. Fire Rating: Class A
- I. Panel NRC: 0.20
- J. Acoustic Infill Panel: Bioacoustic Infill Panel 5823
 - 1. Size: 24" x 24" x 5/8"
 - 2. Color: Black Matte
 - 3. NRC: 0.75
- K. Hanger Wire: Manufacturers standard 12 gauge hanger wire.
- L. Suspension System shall be Heavy Duty 15/16" exposed tee grid.
- M. Provide all necessary components for suspension system, including T-bar hook, wood screws, safety cable, and support hangers.
- N. Provide all necessary trim components in matching veneer color.
- O. Provide integrated light connection clip as necessary for lighting installation within panel system.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not proceed with installation until all wet work such as concrete, plastering and painting has been completed and thoroughly dried out.
- B. Proper designs for both supply air and return air, maintenance of the HVAC filters and building interior space are essential to minimize soiling. Before starting the HVAC system, make sure supply air is properly filtered and the building interior is free of construction dust.

3.02 PREPARATION

3.03 INSTALLATION

- A. Wood Beam Ceiling Systems:
 - 1. Wood Beam System shall be handled and installed with care in order to prevent surface and structure damage. Field cutting shall be kept to a minimum and performed as recommended by manufacturer.
 - 2. The Wood Beam ceiling system shall be suspended by threaded rod on 4' centers according to manufacturers suggested layout instructions.
 - 3. Beams shall be installed by screwing each suspension plate into the internal structure of the wood beam.
- B. Linear Veneered Plank Panel Ceiling Systems:
 - 1. Install suspension system. Suspension system will not line up with the panel edges. Main beams are located one foot in from the short sides of the panels and then at 2' centers. Cross tees shall be placed directly over the edges of the long sides of the panels.

2. Install wall molding per manufacturer's written instructions. Utilize size as required by local jurisdiction and provide all necessary clips and attachments.
3. Install support hangers and hanger wire as required but not less than every 4 feet along the main. Where sections of support hanger are joined together, overlap one notch and secure with framing screws inserted through the holes provided.
4. Install main beams per manufacturer's written instructions. Secure edge of the grid at two adjacent walls by attaching to the wall molding flange.
5. Cut the panels as required using standard wood working tools and a straight edge. A table saw is recommended for straight cuts.
6. Verify the orientation of the hooks when attached to the predrilled holes on the back of the panel. Install starting row such that the open side of the hooks will be facing the wall. Cut panel as required considering the reveal dimensions required.
7. If cutting a panel removes any of the hook attachment holes, relocate hook attachment holes prior to cutting.
8. Should the long edge of the panel require cutting, utilize a straight edge to draw a straight line across the back of the panel through the factory holes. Cut the panel to size. Attach a T-Bar hook to each set of factory drilled holes. Measure the grid opening and place clips on the reference lines so that the dimension from the outer edge of the factory located clip to the outer edge of the relocated clip matches the grid opening dimension. Drill pilot holes at new screw locations. Use a stop on the drill to prevent penetrating through the panel. Attach relocated clips.
9. Should the short edge of the panel require cutting, up to 10" may be cut from the edge without moving clip locations. When more than 10" is removed, carefully measure back 12" from the factory holes toward the center of the panel and draw lines across the back of the panel. Cut the panel and attach the hooks to the factory holes and on the lines. Be sure to maintain the correct position along the lines. Measure the factory holes for uncut edges. In the event that a backer panel is going to interfere with the new location of the clips, the backer shall be repositioned and reattached so there is a minimum of 3" clearance between the backer and the clips.
10. Attach clips (t-bar hooks) at each set of factory drilled pilot holes on each panel. Screw in place.
11. Cut panel edges that are exposed to view shall receive edge banding installed with either finger pressure or a small trim roller. Trim excess material with a sharp knife blade.
12. Install the panels per manufacturer's written instructions. Raise first row of panel hooks above the level of the grid and move the panel toward the wall. Lower the clips onto the bulbs of the main beams. The clips will fit between the cross tees and center the panels under the grid opening. Attach safety cables at diagonal corners of the panel. Cinch the top end of the cable around the main beam and connect the clip at the other end to one of the holes on the hook. For middle rows, apply hooks and install in the same direction as the first row. Attach two safety cables to each panel as they are installed. For the final row of panels, reverse installation so that they install with the open side of the hooks facing the end wall. Raise the factory end of the panel up and over the end of the one in the next to last row to allow the hooks to clear the grid. Shift the panel up and toward the wall to engage the hooks onto the main beams. Install safety cables as the installation progresses. Cables on the last panel must be attached before the panel is positioned in the ceiling.

3.04 ADJUSTING AND CLEANING

- A. Clean using a soft, dry cloth per manufacturer's written instructions.
- B. If heavier cleaning is required, utilize one of the following methods:
 1. A commercial vacuum system with 100-inches/H₂O vacuum capacity is recommended for removing dust particles. The vacuum system cleaning attachment should be a 3" diameter wand with natural hair bristle. A HEPA vacuum filter is recommended to minimize air borne dust during the cleaning process. Care must be taken while vacuuming to avoid

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excessive pressure. Use a blotting action to minimize potential damage of surface texture on ceiling and wall panels.

2. Using a clean damp cloth or soft, smooth sponge with a mild, clear detergent, wipe lightly on the surface to remove any dirt. Dry any excess moisture with a clean, white microfiber cloth. Note: If moisture is not removed, it may stain the surface over time.

**SECTION 09 6500
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Luxury vinyl tile flooring.
- C. Resilient base.
- D. Installation accessories.

1.02 REFERENCE STANDARDS

- A. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile in Modular Format such as Tile(s) or Plank(s); 2024.
- B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
- C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

1.03 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures, for submittal process.
- B. Product Data: Provide data on all specified products and accessories, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Verification Samples: Submit two samples, 2 x 2 inch (51 x 51 mm) minimum in size illustrating color and pattern for each resilient flooring product specified.
- E. Concrete Testing Standard: Submit a copy of ASTM F710.
- F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
- G. Maintenance Data: Include maintenance procedures, recommended maintenance materials.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Resilient Flooring: Quantity equal to 2 percent of total installed for each resilient flooring type and color.
 - 3. Extra Wall Base: 20 linear feet (6 linear meters) of each type and color.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect roll materials from damage by storing on end.
- B. Deliver products to Project site in original manufacturer's unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

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- C. Store products in dry spaces protected from the weather with ambient temperatures maintained between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C).
- D. Move products into spaces where they will be installed at least 48 hours in advance of installation.

1.06 QUALITY ASSURANCE

- A. Single-Source Responsibility for products: Obtain each type and color of product specified from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- B. Fire Performance characteristics: Provide products with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Cove Base:
 - a. Class B rating in ASTM E-84, NFPA 255, UL No. 273, ANSI 2.5, UBC No. 42.1 "Tunnel Test" with a smoke density of 150-200.

1.07 FIELD CONDITIONS

- A. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
- B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).
- C. Close spaces to traffic during installation of products specified in this Section.

1.08 SEQUENCING AND SCHEDULING

- A. Sequence installing products specified in this Section with other construction to minimize possibility of damage and soiling during remainder of construction period.

1.09 WARRANTY

- A. LVT Warranty: Manufacturers standard 25 year commercial warranty that the resilient product will be free from manufacturing defects during the period of this warranty, including delamination, core voids, thickness variation, and dimensional stability defects. The warranty shall cover wear due to normal foot traffic will not wear through the pattern layer of the product.
- B. Rubber Base Warranty: Manufacturer's standard 5 year commercial warranty for manufacturing defects.

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. Luxury Vinyl Tile (**LVT-1, LVT-2, LVT-3**): Solid vinyl with color and pattern throughout thickness, and:
 - 1. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
 - 2. Slip Resistance ASTM D2047: ADA Compliant
 - 3. Static Load Limit ASTM F970: 1500 psi
 - 4. Residual Indentation F1914: passes , 8%
 - 5. Flexibility ASTM F137: Passes
 - 6. Resistance to Heat ASTM F1514: Passes
 - 7. Resistance to Light ASTM F1515: Passes
 - 8. Resistance to Chemicals ASTM F925: Passes
 - 9. Radiant Flux ASTM E648: / 0.45 W/sq. cm., Class I
 - 10. Smoke Density ASTM E662: Passes, <450
 - 11. Size: 6 x 36 inch (152 x 914 mm) long plank unless otherwise indicated in Drawings.
 - 12. Size: 9 x 48 inch long plank unless otherwise indicated in Drawings.
 - 13. Wear Layer Thickness: 40 mil, 0.04 inch (1.016 mm).

14. Finish: UV Urethane
15. Pattern: As Indicated in Drawings.
16. Installation: Glue Down
17. Manufacturers:
 - a. Basis of Design Product (**LVT-1, LVT-2, LVT-3**): Subject to compliance with requirements, provide the products listed in the Drawing Finish Key. Specific luxury vinyl tiles are identified in the drawings to establish the color, design intent, and required standard of quality. It is not the intent to preclude the use of other prior approved, acceptable manufacturers.
 - b. Basis of Design Product: Shaw; www.shawcontract.com
 - c. Patcraft
 - d. Mannington
 - e. Or prior approved equal.

2.02 RESILIENT BASE

- A. Resilient Base: ASTM F1861, toeless; top set Style A, Straight.
 1. Manufacturers:
 - a. Basis of Design: Johnsonite, a Tarkett Company; _____: www.johnsonite.com/#sle.
 - b. Mannington Commercial; _____: www.manningtoncommercial.com/#sle.
 - c. Roppe Corporation; Pinnacle Rubber Base - Standard Toe.: www.roppe.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
 2. Height: 4 inch (100 mm).
 3. Thickness: 0.125 inch (3.2 mm).
 4. Length: Roll.
 5. Thickness 1/8"
 6. Inside and Outside Corners NOT ALLOWED.
 7. Color: As Indicated in drawings, or as selected by Architect from manufacturer's full range.
 8. Manufacturers (**RB-1**):
 - a. Basis of Design: Johnsonite, a Tarkett Company, Product - Traditional Cove Base: www.johnsonite.com
 - b. Burke Flooring: www.burkemercer.com.
 - c. Roppe Corp: www.roppe.com.

2.03 ACCESSORIES

- A. Primers, and Seaming Materials: Waterproof; types recommended by flooring manufacturer, and coordinated with Specification Section Crystalline Waterproofing
 1. LVT Primer: Shaw 9050
- B. Adhesives: Bases other than concrete: Water-resistant type recommended by manufacturer to suit resilient flooring product and substrate conditions indicated.
 1. LVT Adhesive:

a. Shaw 4100 spreadable	95% RH	8 lbs	pH 10
b. S150 spray	95% RH	NA	pH 11
c. Shaw 4151 for high moisture	99% RH	10 lbs.	pH 12
d. Shaw 200 for low demand areas	85% RH	5 lbs	pH 5-9
- C. Weld Rod
 1. Heat
 2. Chemical
- D. Take Abatement Coating: Shaw 6200
- E. Barrier Coat Floor Encapsulation: Shaw 9000
- F. Sealer and Wax: Types recommended by flooring manufacturer.

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1. Minimum Number of Wax Coats: 4 coats minimum in classrooms, 6 coats minimum in corridors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
 1. Concrete floors shall be flat and smooth within 1/8" in 6 feet or 3/16" in 10 feet
- B. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
 1. Test as Follows:
 - a. Internal Relative Humidity: ASTM F2170.
 2. Concrete substrates to receive LVT shall not exceed 90% RH. The PH of the concrete must be between 7 and 10.

3.02 PREPARATION

- A. Clean substrate.
- B. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Fit joints and butt seams tightly.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
- C. LVT Installation:
 1. Install using conventional tile and plank installation techniques. Plank products should have a minimum of 6 to 8" seam stagger.
 2. Center rooms and hallways so borders are not less than half of a tile or plank.
 3. Work out of multiple boxes at the same time.
 4. In hallways and small spaces, work lengthwise from one end.
 5. Ensure cut edges are always against the wall.
 6. To cut products, score the top side of the material with a utility knife. Bend the product and finish the cut through the back side. It may be necessary to use a heat gun to cut around vertical obstructions. Allow the heated product to return to room temperature before installation.
 7. If you cut the product into a fine point, it may delaminate. Use an ethyl cyanoacrylate-based super glue to fuse the points together. Clean all glue from the top surface immediately. Alcohol-based super glues may cause the vinyl to swell.
 8. Roll the plank or tile with a 3-section 100 lb. roller. Re-roll the floor within the working time of the adhesive. Continue to roll the floor throughout the working day to ensure a proper bond.
 9. Use floor protection after installation. DO NOT use a plastic adhesive-based protection system

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

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- B. Install base on solid backing. Bond tightly to wall and floor surfaces.
- C. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.
- C. LVT Initial Maintenance:
 - 1. Sweep, vacuum or dust mop to remove dirt and grit.
 - 2. If needed, add neutral cleaner to cool water following the manufacturer's instructions.
 - 3. Scrub with a low-rpm machine or auto scrubber. Use a red pad or brush.
 - 4. Never use brown or black pads (too aggressive and can damage the product)
 - 5. Remove the cleaning solution with a wet-dry vacuum or auto scrubber until the floor is dry.
 - 6. Rinse the floor with clean water. Repeat the rinse process if necessary to remove all haze
- D. LVT Routine Maintenance
 - 1. Sweep, vacuum or dust mop to remove dirt and grit.
 - 2. Add neutral pH cleaner to cool water following the manufacturer's instructions.
 - 3. As needed, scrub with a low-rpm machine or auto scrubber to retain appearance. Use a red (light scrubbing) pad and neutral cleaner following the manufacturer's instructions

3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.
- B. LVT Preventative Floor Care:
 - 1. Use walk-off mats that are as wide as the doorway and long enough for soil load and weather conditions.
 - 2. Use mats with a non-staining backing.
 - 3. Floor protectors should be used on all furniture legs.
 - 4. The surface area of the floor protectors should be no less than 1" in diameter
- C. VCT Maintenance and Care:
 - 1. Clean floor thoroughly of any loose dust, grit, and debris. Remove any dried adhesive residue with a clean, white cloth dampened with mineral spirits, carefully following the warnings on the container. Damp mop the floor with a properly diluted neutral (ph 6 to 8) detergent solution.
 - 2. Protect all doors, millwork, and adjacent surfaces in preparation for wax installation. Contractor will be responsible for removal of wax from these surfaces and any damage that results.
 - 3. Install a minimum of two wax coats per the manufacturer's written instructions on all vinyl composition flooring immediately after installation of the flooring to temporarily protect the floor until regular maintenance procedures can begin. Ensure that areas being waxed are blocked off from traffic until wax has cured per manufacturer's written instruction.
 - 4. Machine scrub the floor with a properly diluted neutral detergent solution and a scrubbing pad or equivalent brushes as recommended by the manufacturer. Do not use pads more abrasive than manufacturer recommends as this can damage the floor finish. If the floor is badly soiled and/or scratched, strip it using the same procedure but substituting a properly diluted stripping solution. The use of aggressive strippers such as a mop-on/mop-off, no-scrub and no-rinse strippers shall not be permitted.
 - 5. Thoroughly rinse the entire floor with fresh clean water. Remove rinse water and allow the floor to dry completely.
 - 6. Apply a additional wax coats (for a total minimum of four coats in classrooms and six coats in corridors) of high quality commercial floor polish. If the floor has been stripped, the application of a stain resistant sealer prior to the application of polish is required in areas exposed to heavy traffic or staining agents.

**SECTION 09 6813
TILE CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.
- B. Section 07 1616 - Crystalline Waterproofing: Concrete Sealant

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- F. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.
- G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures. For carpeting, Owner shall also review carpet submittals.
- B. Product Data: For each type of carpet material, carpet cushion, and installation accessory specified. Submit manufacturer's printed data on physical characteristics, durability, fade resistance, and fire-test-response characteristics. Submit methods of installation for each type of substrate.
- C. Shop Drawings showing columns doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet. Indicate the following:
 - 1. Carpet type, color and dye lot.
 - 2. Locations where dye lot changes occur.
 - 3. Seam locations, types, and methods. Avoid "slivers" to the greatest extent possible; if unavoidable, "slivers" shall be located in least trafficked areas. Seams in wall openings shall be centered on the wall. If the opening has a door, seams shall be centered beneath the door in closed position.
 - 4. Type of subfloor.
 - 5. Type of installation.
 - 6. Pile direction.
 - 7. Transition details to other flooring materials.
- D. Samples for verification of the following products, in manufacturer's standard sizes, showing the full range of color, texture and pattern variations expected. Prepare samples from the same material to be used for the Work. Label each sample with manufacturer's name, material type, color, pattern, and designation indicated on Drawings and carpet schedule. Submit the following:
 - 1. 12-inch square samples of each type of carpet material required.

2. 12-inch samples of each type of exposed edge stripping and accessory item.
- E. Schedule of carpet using same room designations indicated on Drawings.
- F. Manufacturer's Installation Instructions: Indicate special procedures. Manufacturer's statement of acceptance of compatibility of concrete slab curing/sealing materials with carpet adhesive.
- G. Testing Results from Independent Testing Laboratory from previously manufactured carpet materials of identical type to this project illustrating compliance with specified project criteria.
- H. Maintenance data for carpet to be included in the operation and maintenance manual specified in Division 1. Include the following:
 1. Methods of maintaining carpet, including manufacturer's recommended frequency for maintaining carpet.
 2. Precautions for cleaning materials and methods that could be detrimental to finishes and performance. Include cleaning and stain-removal products and procedures.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 6000 - Product Requirements, for additional provisions.
 2. Extra Carpet Tiles: Quantity equal to 1 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who is certified by the Floor Covering Installation Board (FCIB) or who can demonstrate compliance with FCIB certification program requirements.
- B. Single-Source Responsibility: Obtain each type of carpet from one source and by a single manufacturer.
- C. All carpet shall be first quality of American manufacturer and all yarn shall be BASF, ZEFTRON 2000 (R).
- D. Provide flooring material to meet the following test performance criteria as tested by a recognized independent testing laboratory. Certified test reports shall be submitted by the carpet manufacturer for each test method. Requirements listed below must be met by all products being submitted for approval:
 1. Pill Test / DOC-FF-1-70 (ASTM D 2589) - Requirement: Pass
 2. Flooring Radiant Panel / ASTM E 648 - Requirements: Class I (Above 0.45 w/cm).
 3. CRI VOC Chamber Test/Indoor Air Quality test (CRI-IAQ) Green Label Plus Test.
 4. Lightfastness: Rating of not less than 5 on International Grey Scale after 40 SFU's when tested in accordance with AATCC Test Method 165.
 5. Crockfastness: Minimum stain rating on International Grey Scale of not less than 5 wet or dry when tested in accordance with AATCC Test Method 165.
 6. Atmospheric Fading: Burned Gas shall not be less than 5 on International Grey Scale after two cycles on each test as per AATCC Test Method 129 Ozone and AATCC Test Method 23.
- E. Testing: Owner Provided Independent Testing Laboratory will test random samples of actual materials delivered to the site, one sample for each 10,000 sf of carpeted area illustrating compliance with specified project criteria.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104, Section 5: "Storage and Handling".
- B. Deliver materials to Project site in original factory wrappings and containers, labeled with identification of manufacturer, brand name, and lot number.
- C. Store materials on-site in original undamaged packages, inside well-ventilated area protected from weather, moisture, soilage, extreme temperatures, and humidity. Lay flat, with continuous blocking off ground.

1.07 PROJECT CONDITIONS

- A. Comply with CRI 104, Section 6: "Site Conditions".
- B. Space Enclosure and Environmental Limitations: Do not install carpet until space is enclosed and weatherproof, wet-work in space is completed and normally dry, work above ceilings is complete and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.
- C. Subfloor Moisture Conditions: Moisture emission rate of not more than 3 lb/1000 sq. ft./24 hours (14.6 kg/1000 sq. m/24 hours) when tested by calcium chloride moisture test in compliance with CRI 104, 6.2.1, with subfloor temperatures not less than 55 deg F (12.7 deg C).
- D. Subfloor Alkalinity Conditions: A pH range of 5 to 9 when subfloor is wetted with potable water and pHydron paper is applied.

1.08 WARRANTY

- A. The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Carpet Warranty: Submit a written warranty executed by carpet manufacturer and installer agreeing to repair or replace carpet, including all labor and material for the removal of carpet to be replaced, slab preparation, shipping and installation of replacement material, that does not meet requirements for that fails in materials or workmanship within the specified warranty period. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
 - 1. Warranty Period: Life of the installation.
- C. Color Fastness Warranty: Submit a written warranty executed by the carpet manufacturer agreeing to repair or replace carpet, including all labor and material for the removal of carpet to be replaced, slab preparation, shipping and installation of replacement material should the yarn fail to maintain its color.
 - 1. Warranty Period for Lighting: Ten (10) Years
 - a. Carpets shall resist change in color due to sunlight exposure to exceed the equivalent of 4.0 on the gray scale for color change as measured in accordance with AATCC Method 16E.
 - 2. Warranty Period for Atmospheric Conditions: Five (5) Years
 - a. Carpets will resist change in color due to atmospheric contaminants (Ozone and Nitrous Oxides) as measured by AATCC 164 and AATCC 129. Tested carpet will not rate less than a 3.0 rating on the grey scale for color change.
- D. Special Carpet Stain Warranty: Submit a written warranty executed by carpet manufacturer and installer agreeing to repair or replace carpet, including all labor and material for the removal of carpet to be replaced, slab preparation, shipping and installation of replacement material, and agreeing to reimburse the Owner for attempted removal of the stain should the carpet permanently stain.
 - 1. Warranty Period: Ten (10) Years
 - 2. This is not to be construed as a cleaning contract. Owner shall have attempted to remove the stain within three (3) working days after occurrence of the spill and notify carpet manufacturer immediately if the stain removal is unsuccessful.
- E. Special Carpet Static Warranty: Submit a written warranty executed by carpet manufacturer and installer agreeing to repair or replace carpet, including all labor and material for the removal of carpet to be replaced, slab preparation, shipping and installation of replacement material, should carpet cause static or induce malfunction of electronic equipment when installed throughout the equipment operation area.
 - 1. Static is defined as the electric charge built up and later discharged from a person, cart, or other objects as a result of movement of that person or object upon the floor covering.

2. Malfunction is defined as any failure of the electronic equipment caused by carpet induced static electricity, provided the equipment is operating within specifications in every other respect.
3. Electronic Equipment is any computer, work processor, terminal, or other peripheral component communications processor, typesetter or broadcast equipment sold by a recognized manufacturer (or its authorized distributor, agent, or representative) and installed and serviced by qualified personnel.
4. Warranty Period: Life of the installation

PART 2 PRODUCTS

2.01 CARPET TILE

- A. Basis of Design Products: Subject to compliance with requirements, provide the products listed in the Drawing Finish Key. Specific carpets are identified in the drawings to establish the color, design intent, and required standard of quality. It is not the intent to preclude the use of other prior approved, acceptable manufacturers.
 1. Basis of Design: As indicated in the Finish Key
 - a. Type **C-1**, Metal Edge, by Shaw Contract. Size: 24"x24", Installation: Brick.
 - b. Type **C-2**, Familiar, by Shaw Contract. Size: 9"x36", Installation: Ashlar.
- B. Size: As indicated in the Drawing Finish Key.
- C. Applied Soil-Resistance Treatment: Manufacturer's standard material.
- D. Antimicrobial Treatment: Manufacturer's standard material.
- E. Performance Characteristics (**C-1, C-2**): As follows:
 1. Pill Test: Pass
 2. NBS Smoke: Less than 450
 3. Electrostatic Propensity: Less than 3.5 kv
 4. ADA Compliance: >0.6, meets the recommended static coefficient of friction for ADA walking surfaces and accessible routes.
- F. Environmental Requirements: Provide carpet tile that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

2.02 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Edge Strips: Embossed aluminum, color as selected by Architect.
- C. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements to installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive must be asbestos free.
- D. Rubber Edge Strips: Rubber or vinyl in manufacturer's standard matching carpet, of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 EXECUTION

3.01 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 performance of carpet. Do not proceed with installation until unsatisfactory conditions have been corrected.

- B. Verify that subfloors and conditions are satisfactory for carpet installation and comply with requirements specified in this Section and those of the following:
 - 1. Carpet manufacturer.

3.02 PREPARATION

- A. Comply with carpet manufacturer's installation recommendations to prepare substrates indicated to receive carpet installation.
- B. Level subfloor within 1/4 inch in 10 feet noncumulative, in all directions. Sand or grind protrusions, bumps, and ridges. Patch and repair cracks and rough areas. Fill depressions.
 - 1. Use leveling and patching compounds to fill cracks, holes, and depressions in subfloor as recommended by the following:
 - a. Carpet manufacturer.
- C. Remove subfloor coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone.
- D. Broom or vacuum clean subfloors to be covered with carpet. Following cleaning, examine subfloors for moisture, alkaline salts, carbonation, or dust.
- E. Concrete-Subfloor-Preparation: Apply concrete-slab primer, according to manufacturer's directions, where recommended by the following:
 - 1. Carpet manufacturer.
- F. Coordinate on-carpet and in-carpet items including but not limited to door stops, cleanouts, floor receptacles, thresholds for proper design function and fit. Carpet flanges for floor outlets and cleanouts shall accomplish level, flush walking surface.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Comply with carpet manufacturer's recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under door in closed position. At wall openings, seams shall be centered on the wall. Do not bridge building expansion joints with continuous carpet. "Slivers" of carpet shall be avoided wherever possible, but if unavoidable shall be located in least-trafficked areas.
- C. 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.
- D. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- E. Extend carpet under all moveable furnishings, equipment or fixtures unless otherwise noted.
- F. Fully adhere carpet tile to substrate.
- G. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing installation.
 - 1. Remove visible adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove protruding yarns from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Comply with CRI 104, Section 15: "Protection of Indoor Installation".
- C. Provide final protection and maintenance conditions, in a manner acceptable to manufacturer and Installer, that ensure carpet is without damage or deterioration at the time of Substantial Completion.
- D. Remove excess adhesive without damage, from floor, base, and wall surfaces.

E. Clean and vacuum carpet surfaces.

SECTION 09 7200 WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Paper back and Vinyl Wall Coverings.

1.02 RELATED REQUIREMENTS

- A. Section 09 2116 - Gypsum Board Assemblies

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2025.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data: For each type of product indicated, include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.
- C. Shop Drawings: Show location and extent of each wall-covering type. Indicate veneer matching, seams and termination points.
- D. Samples for Initial Selection: For each type of wall covering indicated.
- E. Samples for Verification: Full width by 36 inch long section of wall covering.
 - 1. Sample from same print run or dye lot to be used for the Work. Mark top and face of fabric.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for wall covering.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Wall Covering Materials: 25 linear feet (8 linear m) of each color and pattern of wall covering; store where directed.
 - 3. Package and label each roll by manufacturer, color and pattern, and destination room number.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

1.06 MOCK-UP

- A. Provide panel, 5 feet (1.524 m) wide, full height, illustrating installed wall covering and joint seaming technique.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Inspect roll materials at arrival on site, to verify acceptability.
- B. Protect packaged adhesive from temperature cycling and cold temperatures.
- C. Do not store roll goods on end.

1.08 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install wall coverings 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.

- B. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 1. Basis of Design (WC-1): Level Wallcovering: <https://findyourlevel.com/>
 2. MDC Wallcoverings: www.mdcwall.com.
 3. Innovations in Wallcovering, Inc.: www.innovationsusa.com.
 4. Len-Tex Wallcoverings: lentexwallcoverings.com.
 5. DesignTex: www.designtex.com.

2.02 MATERIALS

- A. Requirements for Wall Coverings:
- B. Wall Covering - Type **WC-1**: Vinyl Wallcoverings.
 1. Basis of Design Product: Subject to compliance with requirements, provide the products listed in the Drawings and Finish Key. Specific wall coverings are identified in the drawings to establish color, design intent, and required standard of quality. It is not the intent to preclude the use of other prior approved, acceptable manufacturers.
 - a. Basis of Design: As noted on the Interior Finish Schedule.
 - b. Or prior approved equal.
 2. Material: As indicated in the drawings.
 3. Pattern: As indicated in the drawings.
 4. Width: As indicated in the drawings.
 5. Backing: As recommended by wallcovering manufacturer.
 6. Flame Spread: 20
 7. Smoke Developed: 5
 8. Mounting: Adhesive
- C. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and installation conditions to ensure surface conditions meet or exceed a Level 5 finish. Recommended levels of gypsum board finish, and permanent lighting should be installed and operational.
- B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
- C. Verify substrate surface is clean, dry, smooth, structurally sound, and free from surface defects and imperfections that would show through the finished surface.
- D. Evaluate all painted surfaces for the possibility of pigmented bleed through.
- E. Notify the Architect in writing of any conditions detrimental to the proper and timely completion of the installation.
- F. Beginning of installation means acceptance of surface conditions.

3.02 PREPARATION

- A. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
- B. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

3.03 INSTALLATION OF WALL COVERINGS

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall surface immediately prior to application of wall covering. Let contact adhesive set tack free.
- C. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface. Butt edges tightly.
- D. Horizontal seams are not acceptable.
- E. Do not seam within 2 inches (50 mm) of internal corners or within 6 inches (150 mm) of external corners.
- F. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.
- G. Cover spaces above and below windows, above doors, in pattern sequence from roll.
- H. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply with contact adhesive within 6 inches (150 mm) of wall covering termination. Ensure full contact bond.
- I. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 INSTALLATION OF TACKABLE WALL SURFACE

- A. Install per manufacturer's written instructions using manufacturer's technical manager's locally advised adhesive.
- B. Ensure wall conditions are clean, smooth and permanently dry. Repair and fill crevices in non-smooth walls and sand the surface. Be sure walls to be covered are clean and free of dust.
- C. Conduct an adhesive bond test prior to installation of wall surface.
- D. Cut sheets of tackable wall surface to required length including overlap of 2 to 3 inches at least 24 hours prior to installation. Lay sheets flat and allow to acclimate with the permanent HVAC system set at a minimum of 68 degrees F for a minimum of 72 hours prior to, during, and after installation. Store sheets in the room in which they are to be installed. Back roll sheets once in reverse direction to release the roll stretch. Material may shrink lengthwise and expand widthwise.
- E. Remove factory edge from both sides with manufacturer's seam and strip cutter. Trim off a minimum of 1/2 inch. With a utility knife, score material 1/3 of the material thickness. Then with a hooked blade knife, cut along the score line, holding the knife at an angle to slightly undercut the edge. Cut straight along the top edge or direct scribe. The bottom edge should be cut to size by direct scribing during installation. Draw a perpendicular line on the wall for your starting point.
- F. Apply adhesive to wall with a putty knife and spread with a 1/16" square notched trowel in the area of the sheet being applied. If needed, apply 10 to 12 inches of contact adhesive or acrylic dispersion to the upper part of the wall and to the back of the tackable wall surface to prevent the sheet from sliding down.
- G. Press the sheet of tackable wall surface into the fresh adhesive starting with the top edge and the side along the perpendicular line. Work from the top downwards, first widthwise, then lengthwise. Roll firmly through the width then the length with a hand roller to ensure proper transfer of adhesive and to remove all air bubbles. Remove adhesive residue immediately with a damp cloth. Mineral spirits may be used to remove dried adhesive.
- H. Cut the subsequent sheets to the required length including overlap of 2 to 3 inches. Do Not Reverse the Sheet. Install all sheets in the same direction. The overlap at the seam should be a minimum of 1/2 inch. Trim the factory edge on opposite side to prepare for the next seam. Draw a pencil line on the wall where the next seam line will fall. Spread the adhesive with the proper notched trowel. Spread from the edge of the first sheet up to the pencil line at the seam of the second sheet. If needed apply 10 to 12 inches of contact adhesive to the upper part of the wall

and to the back of the tackable wall surface. Immediately after the material has been laid into the wet adhesive, underscribe the seam. Scribe should be set for a net fit so that the material will fall into place without force or pressure. This will compensate for the slight expansion that will occur. Next cut the material along the scribe line using a hooked blade knife and holding it at an angle so as to slightly undercut the material. Roll seam with hand roller. Remove adhesive residue immediately. Dried adhesive can be removed with mineral spirits.

- I. Repeat the same procedure for subsequent sheets.

3.05 CLEANING

- A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.
- B. Reinstall wall plates and accessories removed prior to work of this section.

3.06 PROTECTION

- A. Do not permit construction activities at or near finished wall covering areas.

**SECTION 09 9000
PAINTING AND COATING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints and other coatings.
- C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Elevator pit ladders.
 - 3. Mechanical and Electrical:
 - a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
 - c. Paint interior surfaces of air ducts and convectors and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne, and lead items.
 - 6. Marble, granite, slate, and other natural stones.
 - 7. Floors, unless specifically so indicated.
 - 8. Ceramic and other tiles.
 - 9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
 - 10. Glass.
 - 11. Concealed pipes, ducts, and conduits.
 - 12. Data lines are not to be painted under any circumstance. If any are painted, it is the contractor's responsibility to replace that cable from end to end.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Shop-primed items.
- B. Section 09 9600 - High-Performance Coatings.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data: Provide data on all finishing products, including VOC content.

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- C. Samples: Submit two paper chip samples, 12 X 12 inch (400 X 400 mm) in size illustrating range of colors and textures available for each surface finishing product scheduled.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, submit each color in each sheen available.
 - 3. Where sheen is not specified, discuss sheen options with Grace & Hebert Architects, APAC before preparing samples, to eliminate sheens definitely not required.
- D. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on tempered hardboard, 12 X 12 inch (400 x 400 mm) in size.
- E. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.
- F. Manufacturer's Instructions: Indicate special surface preparation procedures.
- G. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum seven years experience.

1.06 MOCK-UP

- A. Apply mock-ups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Shower ceilings.
 - c. Other items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

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- C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- E. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.
- F. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

1.09 EXTRA MATERIALS

- A. See Section 016000 - Product Requirements, for additional provisions.
- B. Supply 1 gallon of each color; store where directed.
- C. Label each container with color in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
- C. Paints:
 - 1. Basis of Design: Sherwin Williams Company: www.sherwin-williams.com.
 - 2. Benjamin Moore & Co: www.benjaminmoore.com/#sle.
 - 3. Scuffmaster; Master Technologies, Inc.
- D. Primer Sealers: Same manufacturer as top coats.
- E. Block Fillers: Same manufacturer as top coats.
- F. Substitutions: Prior approved equal only.

2.02 PAINTS AND COATINGS - GENERAL

- A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
 - 1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each coating material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
 - 1. Gypsum Board: Interior Institutional Low Odor/VOC Primer Sealer.
 - 2. Concrete: Interior Institutional Low Odor/VOC Primer Sealer.
 - 3. Wood: Latex Primer for Interior Wood.
 - 4. Galvanized Steel: Interior Water Based Galvanized Primer.
- C. Volatile Organic Compound (VOC) Content:

1. Provide coatings that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - 1) Flat Paints and Coatings: 0 g/L.
 - 2) Nonflat Paints and Coatings: 0 g/L.
 - 3) Industrial Maintenance Coatings: 250 g/L.
 - 4) Dry-Fog Coatings: 150 g/L.
 - 5) Primers, Sealers, and Undercoaters: 100 g/L.
 - 6) Anticorrosive and Antirust Paints Applied to Ferrous Metals: 100 g/L.
 - 7) Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 - 8) Pretreatment Wash Primers: 420 g/L.
 - 9) Floor Coatings: 50 g/L.
 - 10) Shellacs Clear: 730 g/L.
 - 11) Shellacs, Pigmented: 550 g/L.
 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- D. Colors: As indicated on drawings, or as selected by Architect
 1. Allow for minimum of twelve colors for each system, unless otherwise indicated, without additional cost to Owner. Refer to Finish Key and Interior Elevations for color selections.
 2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
 3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.
 4. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color coding scheme indicated.

2.03 PAINT SYSTEMS - EXTERIOR

- A. All Exterior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including concrete masonry and primed metal.
 1. Preparation as specified by manufacturer.
 2. Two top coats and one coat primer recommended by manufacturer.
 3. Primer(s): As recommended by manufacturer of top coats.
- B. Refer to High Performance Coatings for painting of steel framing and cast iron boots.
- C. Fiber Cement Board, Opaque, Latex, 3 Coat:
 1. Do not install on pre-finished fiber cement board elements. Install only on primed fiber cement board elements
 2. One coat masonry primer, as specified as part of this Section.
 3. Satin: Two coats exterior acrylic latex.
 - a. Basis of Design: Sherwin Williams - SW Emerald Exterior Acrylic Satin, A48 Series.
- D. Ferrous Metals, Unprimed, Latex, 3 Coat:
 1. One coat of latex primer.
 2. Gloss: Two coats of latex enamel.
- E. Galvanized Metals, Latex, 3 Coat:
 1. One coat galvanize primer.
 2. Gloss: Two coats of latex enamel.

2.04 PAINT SYSTEMS - INTERIOR

- A. All Interior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, uncoated steel, shop primed steel, and galvanized steel.
 1. Primer(s): As recommended by manufacturer of top coats.
- B. Wood, Opaque, Latex, 3 Coat:

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1. One coat of latex primer sealer.
2. Semi-gloss: Two coats of latex enamel.
- C. Wood, Transparent, Varnish, Stain:
 1. One coat of stain; as specified.
 2. One coat sealer ; as specified.
 3. Satin: One coat of varnish; as specified.
- D. Ferrous Metals, Primed, Latex, 2 Coat:
 1. Touch-up with latex primer.
 2. Semi-gloss: Two coats of latex enamel.
- E. Galvanized Metals, Latex, 3 Coat:
 1. One coat galvanize primer.
 2. Semi-gloss: Two coats of latex enamel; ____.
- F. Gypsum Board/Plaster, Latex, 3 Coat:
 1. One coat of latex primer sealer.
 2. Eggshell: Two coats of latex enamel; at areas specified.
 3. Flat: Two coats of latex enamel; Ceilings.
- G. Gypsum Board/Plaster, Epoxy System, 3 Coat:
 1. One coat interior latex primer/sealer.
 2. Semi-gloss: Two coats of waterbased epoxy gypsum board coating; at all wet areas - restrooms, locker rooms, shower areas, etc.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 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. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Plaster and Stucco: 12 percent.
 3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 5. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
 6. Concrete Floors and Traffic Surfaces: 8 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.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to coating application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

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- C. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- I. Concrete Floors and Traffic Surfaces to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- J. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- K. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
- L. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- M. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- N. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
- O. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

3.03 APPLICATION

- A. Apply paints according to manufacturer's written instructions:
 - 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.

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- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color and appearance.
- D. 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.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Refer to Divisions 21, 22, 23, 26, 27 and 28 for painting requirements where indicated.

3.04 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.

SECTION 10 1400 SIGNAGE

PART 1 GENERAL

1.01 SUMMARY

- A. Work required for this section includes code required signs, including ADA, and supplementary items necessary to complete their installation.
- B. Handicapped Bathroom Signage
- C. Emergency Exit Signage
- D. Room and door signs.
- E. Emergency evacuation maps.
- F. Dimensional and vinyl graphics.
- G. Projecting wayfinding signs.

1.02 RELATED REQUIREMENTS

- A. Division 26 Electrical

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures, for submittal process.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. Submit for approval by Owner through Architect prior to fabrication.
- D. Shop Drawings:
 - 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 plaque at least half size.
 - 4. Show locations of electrical service connections.
 - 5. Include diagrams for power, signal, and control wiring.
- E. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- F. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- H. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.05 QUALITY ASSURANCE

- A. Obtain all signage products in this and other signage specifications through a single supplier from a single manufacturer.
- B. Products shall meet requirements of the Americans With Disabilities Act Accessibility Guidelines (ADAAG) and local amendments and modifications.

- C. Installation shall be performed by an installer specialized and experienced in work similar to that required for this project.
- D. Sign supplier to provide Online Reorder website for use by Owner to order additional signs. Reorder website to include sign descriptions, drawings and cost.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

1.08 WARRANTY

- A. Project Warranty: Comply with requirements of Division 1.
- B. Manufacturer's Warranty: Submit manufacturer's standard warranty document executed by authorized company official.
 - 1. Warranty Period: One year from date of substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Basis of Design: ASI Signage Innovations, 520 Commerce Point, Harahan, LA 70123 504.704.1000: www.asisignage.com.
 - a. Contact: Kristen Moore (504) 554-1561, kristen.moore@asisignage.com
 - 2. 2/90 Sign Systems: www.290signs.com
 - a. Or Approved Equal Other manufacturers shall submit an equivalent style signage system 10 days prior to advertised bid before Approval is issued. The equivalency shall be the sole discretion of the architect.
- B. Acceptable Products:
 - 1. Basis of Design: ASI Reflections, LPP Series, LTV Series, and Legacy Series

2.02 SIGN TYPES

- A. Code Required Signage
 - 1. ASI Reflections Series Anodized Aluminum Frames with 3D Printed ADA Ready Sign Inserts
 - a. S-1R/S-1W/S-1M (Restroom ID): 8" h x 6" w Reflections Series Frame with ¼" thick P95 Frosted Acrylic, 2nd Surface Painted (1) Standard Color; Direct Printed Text, Symbols, and Braille; Tape Mount w/ Silicone
 - b. S-2 (Exit ID): 4" h x 6" w Reflections Series Frame with ¼" thick P95 Frosted Acrylic, 2nd Surface Painted (1) Standard Color; Direct Printed Text, Symbols, and Braille; Tape Mount w/ Silicone
 - c. S-3 (Room ID) Reflections Series Frame with ¼" thick P95 Frosted Acrylic, 2nd Surface Painted (1) Standard Color; Direct Printed Text, Symbols, and Braille; Tape Mount w/ Silicone
 - d. S-4 (Office and Conference ID): 6" h x 6" w Reflections Series Frame with ¼" thick P95 Frosted Acrylic, 2nd Surface Painted (1) Standard Color; Direct Printed Text, Symbols, and Braille; Tape Mount w/ Silicone
 - e. S-5 (Evacuation Map ID) 8-1/2" h x 10" w Reflections Series Frame with ¼" thick P95 Frosted Acrylic, 2nd Surface Painted (1) Standard Color; Direct Printed Text, Symbols, and Braille; Tape Mount w/ Silicone
 - 2. ASI LPP Series Laser-Cut Acrylic Letters

- a. S-6 (3-Dimensional Interior Letters): See elevations for size. 3/8" thick Laser-Cut Acrylic with (1) Standard Paint Color; Tape mount
- 3. ASI LTV Series Vinyl Applied Letters
 - a. S-7 (Vinyl Letters): See elevations for size. Standard privacy film or solid color film applied to first surface of glass windows.
- 4. ASI Legacy Series Projecting Signs
 - a. S-8 (Department Wayfinding Flag Signage): 8" h x 32" w x 3/16" thick Acrylic, Painted (1) Standard Color on all sides; Double-sided vinyl graphics (standard vinyl color) with custom aluminum welded projecting mount per sign elevation, Painted (1) Standard color; Screw mount to wall.

2.03 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.

2.04 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signag, 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. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
- B. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- C. Tape Adhesive: Double sided tape, permanent adhesive, for flat signs

2.05 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Comply with AWS for recommended practices in welding and brazing. 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.
 - 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 5. Internally brace signs for stability and for securing fasteners.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

1. Aluminum Brackets: Factory finish brackets to match sign background finish unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of plaque work.
- C. Verify that sign-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.
- D. Verify that electrical service is correctly sized and located to accommodate signs.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.
- F. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to the following, unless otherwise specified:
 1. Respective manufacturer written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.
- C. 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.
- D. Install neatly, with horizontal edges level.
- E. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- F. Locate signs where indicated or as required by Architect.
 1. Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inch (76.2 mm). of sign without encountering protruding objects or standing within swing of door
- G. 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 and Concrete 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.

2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
3. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
5. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of plaque and of suitable quantity to support weight of plaque without slippage. Keep strips away from edges to prevent visibility at plaque edges. Place plaque in position, and push to engage tape adhesive.

3.03 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.
- B. 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.
- C. Remove temporary protective coverings and strippable films as signs are installed.
- D. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.
- E. Protect from damage until Substantial Completion; repair or replace damaged items.

**SECTION 10 2113.19
PLASTIC TOILET COMPARTMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Solid plastic toilet compartments.
- B. Urinal and vestibule screens.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Blocking and supports.
- B. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- C. Product Data: Provide data on panel construction, hardware, and accessories.
- D. Samples: Submit two samples of partition panels, 4 by 4 inch (102 by 102 mm) in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Solid Plastic Toilet Compartments:
 - 1. Basis of Design: ASI Accurate Partitions; _____: www.asi-accuratepartitions.com/#sle.
 - 2. Scranton Products; Hiny Hiders Partitions: www.scrantonproducts.com.
 - 3. ASI Global Partitions.
 - 4. Or prior approved equal..

2.02 PLASTIC TOILET COMPARTMENTS

- A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286, floor-mounted headrail-braced.
 - 1. Fire Rated Materials Class A, NFPA 286, Orange Peel Texture
 - 2. Color: As Selected By Architect from Manufacturer's Full Range.
- B. Doors:
 - 1. Thickness: 1 inch (25 mm).
 - 2. Width: 24 inch (610 mm).
 - 3. Width for Handicapped Use: 36 inch (915 mm).
 - 4. Height: 58 inch (1473 mm).
- C. Panels:
 - 1. Thickness: 1 inch (25 mm).
 - 2. Height: 58 inch (1473 mm).
- D. Pilasters:
 - 1. Thickness: 1 inch (25 mm).
 - 2. Width: As required to fit space; minimum 3 inch (76 mm).

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- E. Screens: Without doors; to match compartments; mounted to wall with continuous stainless steel panel brackets.

2.03 ACCESSORIES

- A. Pilaster Shoes: Stainless steel, satin finish, 3 inches (76 mm) high; concealing floor fastenings.
- B. Head Rails: Extruded aluminum, anti-grip profile.
- C. Pilaster Brackets: Polished stainless steel.
- D. Wall Brackets: Continuous type, polished stainless steel.
- E. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
- F. Hardware: Satin stainless steel:
 - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
 - 2. Door Latch: Slide type with exterior emergency access feature.
 - 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
 - 4. Coat hook with rubber bumper; one per compartment, mounted on door.
 - 5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.
- D. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.02 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.03 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Overhead-Braced and Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.
- F. Floor and Wall-Anchored Screens: Provide pilasters and panels of same construction and finish as toilet compartments. Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

3.04 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch (6 mm).

- B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.05 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

SECTION 10 2800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Electric hand/hair dryers.
- D. Diaper changing stations.
- E. Utility room accessories.
- F. Grab bars.

1.02 RELATED REQUIREMENTS

- A. Section 09 2116 - Gypsum Board Assemblies: Concealed supports for accessories, including in wall framing and plates and above ceiling framing.
- B. Section 10 2113.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Bobrick.
- B. Commercial Toilet, Shower, and Bath Accessories:
 - 1. AJW Architectural Products: www.ajw.com.
 - 2. ASI - American Specialties, Inc: www.americanspecialties.com.
 - 3. Bradley Corporation: www.bradleycorp.com.
 - 4. Or prior approved equal.

2.02 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. General Requirements:
 - 1. Unless otherwise indicated, fabricate units of all-welded construction, with corners and returns as indicated, tight seams and joints, and exposed edges rolled.
 - 2. Fabricate frames drawn and leveled, one-piece seamless construction.
 - 3. Hang doors and access panels with full-length, stainless-steel hinges.
 - 4. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- C. Manufacturer Names or Labels: Not permitted on exposed faces of accessories. Provide printed label or stamped metal nameplate indicating manufacturer's name and product model number on an easily noticeable interior surface or on back surface of each accessory.

- D. Keys: Provide minimum of 6 universal keys for internal access to accessories for servicing and resupplying.
- E. Accessibility Requirements: Products and installation shall comply with Americans with Disabilities Act (ADA), ANSI A 117.1, and state and local accessibility standards.

2.03 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 satin finish; minimum 0.0312 in. (0.8 mm) (22 gage) nominal thickness unless otherwise indicated.
- B. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- C. ABS Plastic: Moldable acrylonitrile-butadiene-styrene resin formulation.
- D. HDPE Plastic: Moldable high-density polyethylene resin formulation.
- E. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- G. Sealant: Silicone mildew resistant sealant specified in Division 07, Section "Joint Sealants".

2.04 COMMERCIAL TOILET ACCESSORIES

- A. Paper Towel Dispenser: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator .
 - 1. Capacity: 400 multifold minimum.
 - 2. Products:
 - a. _____.
 - b. Substitutions: Section 01 6000 - Product Requirements.
 - 3. Product: B-4262 manufactured by Bobrick.
 - 4. P
 - 5. Locations as Indicated in Drawings to receive paper towel dispenser, except where noted above millwork and below lower counters where installation of this model will not fit.
- B. Paper Towel Dispenser: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator.
 - 1. Capacity: 200 multifold minimum.
 - 2. Product: B-26212 manufactured by Bobrick.
 - 3. Locations as Indicated in Drawings to receive paper towel dispenser where noted above millwork and below lower counters and installation of Model B-4362 does not fit.
- C. Automated Soap Dispenser: Liquid soap dispenser, wall-mounted, with stainless steel cover and window to gauge soap level, tumbler lock.
 - 1. Minimum Capacity: 48 ounces (1.5 liters).
 - 2. Products:
 - a. _____.
 - b. Substitutions: Section 01 6000 - Product Requirements.
- D. Grab Bars: Stainless steel, nonslip grasping surface finish.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
 - b. Dimensions: 1-1/2 inch (38 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, exposed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
 - c. Length and Configuration: As indicated on drawings.
 - d. Products:
 - 1) Basis of Design: Bobrick: B-6806 Series.
 - 2) Bradley: Model 832 Series.
 - 3) Or prior approved equal.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

- A. Towel Pin: Stainless steel, 3 inch (75 mm) extension from wall; rectangular-shaped bracket and backplate for concealed attachment, satin finish.
 - 1. Product: B-677 manufactured by Bobrick.
- B. Robe Hook: Heavy-duty stainless steel, single-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.
 - 1. Products:
 - a. _____.
 - b. Substitutions: Section 01 6000 - Product Requirements.

2.06 ELECTRIC HAND/HAIR DRYERS

- A. Electric Hand and Hair Dryers: Traditional fan-in-case type, with downward fixed nozzle.
 - 1. Operation: Automatic, sensor-operated on and off.
 - 2. Mounting: Surface mounted.
 - 3. Cover: Stainless steel with brushed finish.
 - a. Tamper-resistant screw attachment of cover to mounting plate.
 - 4. Air Velocity: 18,000 linear feet per minute (91 m/s), minimum, at full power.
 - 5. Heater: 500 W, minimum, at full power.
 - 6. Total Wattage: 1500 W, maximum.
 - 7. Runtime: Field adjustable or automatic, up to 35 seconds.
 - 8. Air sanitizing and deodorizing without use of chemicals.
 - 9. Supply Voltage: As indicated on drawings.
 - 10. Warranty: 3 years.
 - 11. Electric Hand Dryer Products:
 - a. Excel Dryer Inc; XLERATOR: www.exceldryer.com/#sle.
 - b. Or prior approved equal.

2.07 DIAPER CHANGING STATIONS

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
 - 1. Material: Polyethylene.
 - 2. Mounting: Surface.
 - 3. Interior Color: Gray.
 - 4. Minimum Rated Load: 150 pounds (_____ kg).
 - 5. Products:
 - a. Basis of Design: Gamco BCS-4
 - b. Or prior approved equal.

2.08 UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
 - 1. Hooks: 4, 0.06 inch (1.6 mm) stainless steel rag hooks at shelf front.
 - 2. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 - 3. Length: Manufacturer's standard length for number of holders/hooks.
 - 4. Product: B-239 manufactured by Bobrick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

SECTION 10 5100 LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal lockers.
- B. Locker benches.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood blocking and nailers

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

1.04 SUBMITTALS

- A. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- B. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.
- C. Samples: Submit two samples 4 by 4 inches (102 by 102 mm) in size, of each color scheduled.
- D. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Lockers:
 - 1. Art Metal Products: www.artmetalproducts.com.
 - 2. Lyon Workspace Products: www.lyonworkspace.com.
 - 3. Basis of Design: Penco Products, Inc; Guardian 2-Tier, Solid Door, Classic III Recessed Handle, Finished End Panels, Provide 1 ADA Locker: www.pencoproducts.com.
 - 4. Republic Storage Systems Co: www.republicstorage.com.
 - 5. Or prior approved equal.
- B. Locker Benches:
 - 1. Hollman, Inc.; www.hollman.com
 - 2. Or prior approved equal.

2.02 LOCKER APPLICATIONS

- A. _____: Two tier metal lockers, wall mounted with matching closed base.
 - 1. Width: 18 inches (457 mm).
 - 2. Depth: 21 inches (530 mm).
 - 3. Height: 72 inches (1,830 mm).
 - 4. Fittings: Hat shelf, 2 coat hooks.
 - 5. Locking: Padlock hasps, for padlocks provided by Owner.
 - 6. Provide sloped top.
- B. Locker Benches: Free standing type, with back support; bench top of butcher block maple; painted steel pedestals - T-leg style.
 - 1. Height: 18 inches.
 - 2. Length: 72 inches.
 - 3. Width: 12 inches.
- C. ADA Locker Benches: 1'-8"x3'-6", bench top of butcher block maple.

2.03 METAL LOCKERS

- A. Lockers: Factory assembled, made of formed sheet steel, Cold-rolled mild steel, uncoated, stretcher leveled; metal edges finished smooth without burrs; baked enamel finished inside and out.
 - 1. Where ends or sides are exposed, provide flush panel closures.
 - 2. Provide filler strips where indicated, securely attached to lockers.
 - 3. Color: To be selected by Architect from manufacturer's standard range.
- B. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.
 - 1. Body and Shelves: 24 gage, 0.0239 inch (0.61 mm).
- C. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
 - 1. Door Frame: 16 gage, 0.0598 inch (1.52 mm), minimum.
 - 2. Provide ventilation slots in top and bottom of door frame.
- D. Doors: Hollow double pan, sandwich construction, 1-3/16 inch (30 mm) thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.
 - 1. Door Outer Face: 18 gage, 0.0478 inch (1.21 mm), minimum.
 - 2. Door Inner Face: 20 gage, 0.0359 inch (0.91 mm), minimum.
 - 3. Form recess for operating handle and locking device.
 - 4. Provide ventilation slots in top and bottom of door.
- E. Hinges: Two for doors under 42 inches (1050 mm) high; three for doors over 42 inches (1 050 mm) high; weld securely to locker body and door.
 - 1. Hinge Thickness: 14 gage, 0.0747 inch (1.90 mm).
- F. Sloped Top: 20 gage, 0.0359 inch (0.91 mm), with closed ends.
- G. Number Plates: Provide oval shaped brass plates. Form numbers 3/8 inch (9.5 mm) high of block font style with ADA designation, in contrasting color.

2.04 MATERIALS

- A. Sheet Steel: ASTM A 653/A 653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; to the following minimum thicknesses:
 - 1. Body and Shelf: 24 gage, 0.024 inch (0.6 mm).
 - 2. Door Outer Face: 18 gage, 0.048 inch (1.2 mm).
 - 3. Door Inner Face: 20 gage, 0.036 inch (0.9 mm).
 - 4. Door Frame: 16 gage, 0.060 inch (1.5 mm).
 - 5. Hinges: 14 gage, 0.075 inch (1.9 mm).
 - 6. Base: 20 gage, 0.036 inch (0.9 mm).
 - 7. Sloping Top: 20 gage, 0.036 inch (0.9 mm).
 - 8. Trim: 20 gage, 0.036 inch (0.9 mm).
- B. Accessories For Each Locker: Two double prong wall hooks, coat hanger bar and rubber bumper.

2.05 FABRICATION

- A. Lockers shall be fabricated using blunt joint, nail and screw joinery.
- B. Fabricate lockers square, rigid, and without warp.
- C. Machine all parts and attachment holes accurately and without chips.
- D. Fabricate corners, fillers, scribes, tops as required for installation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install lockers plumb and square.
- C. Place and secure on prepared base.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb (445 N).
- E. Bolt adjoining locker units together to provide rigid installation.
- F. Install end panels, filler panels, and sloped tops.
- G. Install accessories.
- H. Replace components that do not operate smoothly.

3.03 CLEANING

- A. Clean locker interiors and exterior surfaces.

SECTION 10 5300
EXTRUDED ALUMINUM WALKWAY COVERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. The bidding documents, General Conditions, Supplementary Conditions, drawings and requirements of Division One specifications shall apply to Work specified in this Section.

1.02 DESCRIPTION OF WORK

- A. Work in this Section includes extruded aluminum canopies, both post and overhead hanger rod supported, as indicated in drawings.
- B. Definition: Extruded Aluminum Walkway Cover shall consist entirely of extruded aluminum sections (roll-formed not acceptable). System shall consist of heli-arc welded, one-piece rigid structural bents (column and beam assemblies), decking, fascia, accessory items and hardware to provide a complete system.
- C. Water shall drain from deck into designated beams and out at grade level of columns through weep holes.
- D. Engineering Responsibility: Engage a fabricator who assumes undivided responsibility for engineering walkway covers by employing qualified professional engineer, registered to practice in the state of Louisiana, to prepare design calculations, shop drawings, and foundation details to withstand hurricane force winds as indicated in structural drawings.

1.03 REFERENCES

- A. The Aluminum Association (AA):
 - 1. The Aluminum Design Manual 2000, Specifications & Guidelines for Aluminum Structures
- B. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum.
 - 2. AAMA 2603, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 - 3. AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
- C. American Society of Civil Engineers (ASCE):
 - 1. ASCE 7, Minimum Design Loads for Buildings and Other Structures
- D. American Society for Testing and Materials (ASTM):
 - 1. ASTM B 209, Specification for Aluminum and Aluminum- Alloy Sheet and Plate.
 - 2. ASTM B 221, Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 3. ASTM C 150, Specification for Portland Cement.
 - 4. ASTM C 404, Specification for Aggregates for Masonry Grout
- E. American Welding Society (AWS):
 - 1. ANSI/AWS D1.2, Structural Welding Code - Aluminum

1.04 SUBMITTALS

- A. Shop Drawings: Submit detailed drawings, layout of canopy system, bent locations (identify drain columns and wet bents), all mechanical joint locations with complete details, connections, jointing and accessories. Include details of concrete footings and bent anchorage.
- B. Product Data: Submit manufacturer's product data, specifications, component performance data and installation instructions.
- C. Calculations: Provide signed and sealed structural calculations for the proposed canopy and concrete canopy footings, by a professional engineer registered in the state of Louisiana, who professes his discipline to be structural engineering. Design calculations shall state that the

canopy system design complies with the wind requirements of ASCE 7, the stability criteria of applicable building code, and all other governing criteria.

- D. Samples: 2 inch square samples of each finish.

1.05 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following except as otherwise indicated:
1. International Building Code, latest edition with amendments, if any.
 2. AWS (American Welding Society) standards for structural aluminum welding.
 3. Design Walkways in accordance with The Aluminum Design Manual 2000.
 4. Comply with the wind requirements of ASCE 7.
- B. Manufacturer: Obtain aluminum covered walkway system from only one (1) manufacturer, although several may be indicated as offering products complying with requirements. At least ten years experience in the design, fabrication, and erection of extruded aluminum walkway cover systems.
- C. Installer Qualification: Firm with not less than three (3) years experience in installation of aluminum walkway covers of type, quantity and installation methods similar to work of this Section.
- D. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of work. However, allow for adjustments within specified tolerations wherever taking of field measurements before fabrication might delay work.
- E. Shop Assembly: Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- F. Coordination: Coordinate Work of this Section with work of other sections which interface with covered walkway system (sidewalks, curbs, building fascias, fencing, etc.)

1.06 PERFORMANCE REQUIREMENTS

- A. System Performance: Provide aluminum canopy system that has been designed, produced, fabricated and installed to withstand normal temperature changes as well as live loading, dead loading and wind loading in compliance with International Building Code requirements for geographic area in which work is located and as follows:
1. Live Load: As indicated on structural drawings.
 2. Structural design for wind forces: Comply with ANSI A58.1-1982
 3. Design Wind Velocity: As indicated on structural drawings.
 4. Importance Factor: As indicated on structural drawings.
- B. Sizes shown on drawings are to be considered minimum.
- C. Structure shall be capable of sustaining severe hail, hurricane force winds and supporting a concentrated load such as being walked upon.
- D. Provide an all welded extruded aluminum system complete with internal drainage. Non-welded systems are not acceptable.
- E. Provide expansion joints to accommodate temperature changes of 120 degrees F. Provide expansion joints with no metal to metal contact.
- F. Grout: Compressive strength of 2000 psi, minimum

1.07 WARRANTY

- A. Manufacturer shall warrant the entire system against defects in labor and materials for a period of one (1) year commencing on the date of Substantial Completion as established in Division One of these Specifications.
- B. Intention of this warranty is that the manufacturer will come onto the jobsite and do all necessary to effect corrections of any deficiencies

- C. Prima Fascia Evidence of defects in labor and material may include but is not limited to, one or more of the following:
 - 1. Moisture leaks
 - 2. Metal failure including excessive deflection.
 - 3. Fastener failure
 - 4. Finish failure
- D. Provide two (2) year finish warranty on anodized finishes.
- E. Provide ten (10) year finish warranty on 3 coat fluoropolymer finishes against fading, chipping, scratching, and cracking.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following manufacturers:
 - 1. Avedek Walkway Cover Systems.
 - 2. Mapes Architectural Canopies - Super Lumideck Extruded, Lincoln, Nebraska, 1.888.273.1132; www.mapes.com.
 - 3. DITT-Deck Extruded Aluminum Walkway Cover System by Dittmer Architectural Aluminum.
 - 4. Basis of Design: Peachtree Protective Covers, www.peachtreecovers.com
 - 5. Or prior approved equal.

2.02 MATERIALS

- A. All aluminum extrusions shall be alloy 6063 heat treated to a T-6 temper.
- B. Finish:
 - 1. Finish for all components shall be Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matted, Anodic Coating: Architectural Class I, clear coating 0.7 mils or thicker), complying with AAMA 611.
 - 2. Finish for all components shall be High performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
 - a. Fluoropolymer Three-Coat Coating System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - b. Color to be selected by Architect from Manufacturer's Full Range.
- C. Columns:
 - 1. Radius-cornered aluminum tubular extrusion, size as required by manufacturer structural engineering design.
 - 2. Grout Key: Provide two 1-1/2 inch diameter holes in column base, one each in opposite sides.
 - 3. Provide clear acrylic protection coat on surfaces in contact with grout.
- D. Beams: Open top aluminum tubular extrusions.
 - 1. Size and Profile: As required by manufacturer's structural engineering design.
 - 2. Provided welded endplate water dams where sections terminate at other than drainage channels.

- E. Fascia: Manufacturer's standard extruded aluminum fascia sections as required to complete the installation resulting in a neat finished appearance.
 - 1. Include manufacturer's standard extruded aluminum gutters.
 - 2. Provide fascia splices where continuous runs of fascia are jointed. Locate splices to be in line with bents and fasten in place on hidden or non-vertical surfaces.
- F. Gutter Fascia: Where applicable provide "j-shaped" gutter fascia capable in manufacturer's standard sizes.
- G. Hanger Assemblies: Provide extruded aluminum hanger rods in manufacturer's standard shapes and sized to meet the loads seen by canopy.
- H. Fasteners:
 - 1. Deck Screws (rivets not permitted): Type 18-8 non-magnetic stainless steel sealed with neoprene "O" ring beneath 5/8" outside dimension, conical washer.
 - 2. Fascia Rivets: Size 3/16" by 1/2" grip range aluminum rivets with aluminum mandrel.
 - 3. Bolts: All bolts, nuts and washers to be 18-8 non-magnetic stainless steel.
 - 4. Tek Screws: not permitted.
 - 5. Other Fasteners: Type 18-8 stainless steel, type recommended by manufacturer for specific condition.
 - 6. Hanger Rods and Attachments: Shall be sized as per manufacturer's recommendations and engineered calculations.
- I. Grout:
 - 1. Portland Cement: ASTM C 150, Type I.
 - 2. Sand: ASTM C 404.
 - 3. Water: Potable
 - 4. Mixing: 1 part portland cement to 3 parts sand, add water to produce a pouring consistency
- J. Gaskets: Dry seal santoprene pressure type.
- K. Aluminum Flashing: ASTM B 209, Type 3003 H14, 0.040 inch, minimum.

2.03 FABRICATION

- A. Comply with indicated profiles, dimensioned requirements and structural requirements.
- B. Shop Assembly: Assemble components in shop to greatest extent possible to minimize field assembly.
- C. Use sections true to details with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture, free from defects impairing strength and durability.
- D. All welding to be done by heli-arc process. Welding to be in accordance with ANSI/AWS D1.2
- E. Bents shall consist of shop welded one piece units. Factory assemble beams to columns to form one-piece rigid bents. When size of bents do not permit shipment as a welded unit, concealed mechanical joints may be used. Where used make welds smooth and uniform using an inert gas shielded arc. Perform suitable edge preparation to assure 100% penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Rigid mechanical joints can be used if supported by engineering calculations and/or testing.
- F. Mechanical joints shall consist of stainless steel bolts with a minimum of two (2) bolts per fastening. Bolts and nuts shall be installed in a concealed manner utilizing 1/2" thick by 1 1/2" aluminum bolt bars welded to structural members. All such mechanical joints must be detailed on shop drawings showing all locations.
- G. Roof Deck: Extruded Aluminum shapes, interlocking self-flashing sections. Shop fabricate to lengths and panels widths required for field assembly. Where used make welds smooth and uniform using an inert gas shielded arc. Perform suitable edge preparation to assure 100% penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Rigid mechanical joints can be used if supported by

engineering calculations and/or testing. Depth of sections to comply with structural requirements. Provide shop induced camber in deck units with spans greater than 16'-0" to offset dead load deflections. Welded dams are to be used at non-draining ends of deck.

- H. Columns: Provide radius-cornered tubular extrusions with cutout and internal diverter for drainage where indicated. Circular downspout opening in column not acceptable.
- I. Beams: Provide open-top tubular extrusion, top edges thickened for strength and designed to receive deck members in self-flashing manner
- J. Expansion joints, design structure for thermal expansion and contraction. Provide expansion joints as required.
- K. Exposed rivets used to fasten bottom of fascia to deck to have finish to match fascia.
- L. Apply a shop applied dip-coat of clear acrylic enamel to each column end terminating in concrete to insulate from electrolytic reaction. Column ends shall be pierced to "key" grout to bent for maximum uplift protection.

2.04 APPLICATIONS

- A. "U-Bent" Style with internal drainage beams/columns. Refer to Drawings for Locations.
 - 1. Finish: Three Coat Fluoropolymer Finish.
- B. "Cantilever Bent" Style with internal drainage beams/columns. Refer to Drawings for Locations.
 - 1. Finish: Three Coat Fluoropolymer Finish.
- C. "T-Bent" Style with internal drainage beams/columns. Refer to Drawings for Locations.
 - 1. Finish: Three Coat Fluoropolymer Finish.
- D. "Standard Hanger Canopy" Style. Refer to Drawings for Locations.
 - 1. Finish: Three Coat Fluoropolymer Finish.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle covered walkway system components as recommended by manufacturer. Handle and store in a manner to avoid deforming members and to avoid excessive stresses.

3.02 EXAMINATION

- A. Examine adjacent work for conditions that would prevent quality installation of system. Verify that all concrete, masonry, and roofing work in the vicinity is complete and cleaned.
- B. Do not proceed until defects are corrected.

3.03 CONCRETE FOOTINGS

- A. Concrete footings are to be part of the Work of this Section.
- B. Sleeves (styrofoam blockouts) shall be furnished and installed by walkway cover manufacturer & installer.

3.04 FIELD DIMENSIONS

- A. General Contractor shall field confirm bent locations, dimensions and elevations shown up on shop drawings prior to fabrication.

3.05 INSTALLATION

- A. Erection: Set roof support frames (bents) into pockets provided in top of footings; set to required elevations, align, plumb and level; and grout in place with 2,000 psi Portland cement grout. Assure that grout fills all voids and "keys" to columns. Fill downspout units with grout to bottom of discharge level. Install aluminum deflectors after grouting. Follow manufacturer's instructions. Match to finish and elevation of adjacent sidewalks.

- B. Install roof deck sections, accessories and related flashing in accordance with manufacturer's instructions. Provide roof slope for rain drainage without ponding water. Align and anchor roof deck units to structural support frames.
- C. Provide hairline miters and fitted joints.
- D. Assemble all components in a neat, workmanlike manner.

3.06 FLASHING

- A. Flashings: Flashings required between covered walkway system and adjoining structures are not work of this Section. Refer to "Sheet Metal Flashing and Trim", Section 076200.

3.07 CLEANING AND PROTECTION

- A. Damaged Units: Replace roof deck panels and other components of the Work which have been damaged or have deteriorated beyond successful minor repair.
- B. Cleaning: Remove protective coverings at time in project construction sequence which will afford greatest protection of Work. Clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.
- C. Protection: Advise Contractor of protection and surveillance procedures, as required to ensure that Work of this Section will be without damage or deterioration at time of Substantial Completion.

SECTION 10 5592 BOOK DROPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Thru-Wall Book Depository

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for component items, physical sizes, clearances required .
- C. Shop Drawings: Indicate locations, vertical construction and anchorage details, dimensions, rough openings required, size and tolerances of floor openings.
- D. Samples: Submit One _____, ____ by ____ inch (____ by ____ mm) in size, illustrating metal finishes.
- E. Manufacturer's Instructions: Include installation procedures, coordination requirements, and maintenance instructions.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Warranty: Provide Manufacturer's standard warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Book Drops:
 - 1. Basis of Design: Kingsley Companies; KwikDrop Single ThruWall;<https://kingsley.com>.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

- A. Comply with applicable code for floor opening requirements and seals.
- B. Comply with ADA requirements.

2.03 BOOK DROP FEATURES

- A. Materials: Exterior facing heavy-duty stainless-steel faceplate with aluminum grade aluminum for the interior chute and housing.
- B. Locking Method: locking and unlocking of the depository door with a push or pull knob.
- C. Theft Deterrence
- D. Weather and Air Block: Product to be equipped with neoprene rubber panels that help prevent most outside air from entering the building when the depository flap is opened to deposit items.
- E. Weather Resistance: Angled built-in weather hood to shield from rain and snow.
- F. Standard Wording Options: Self-adhesive vinyl decal.
- G. ADA Compliant
- H. Overall Dimensions: 20" W x 17.25" D x 13" H; Depository Opening 15" W x 3.75" H

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that field measurements are as indicated.
- B. Verify that surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Ensure ADA mounting height compliance. Refer to the Drawings and manufacturer's instructions.
- C. Coordinate rough wall opening size with manufacturer's requirements to accommodate book drop product.
- D. Prior to installing the unit, add sealant or gasket material around the inside edge of the front plate on all four sides.
- E. Install sealant around the outer edge on all four sides of the face plate and remove excess sealant to finish.
- F. Install mounting fasteners per the manufacturer's instructions.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/8 inch (3 mm).
- B. Maximum Offset From True Dimensional Alignment: 1/4 inch (6 mm).

3.04 CLEANING

- A. Clean chute interior and finish trim surfaces.
- B. Remove strippable temporary protection after adjacent work is complete.
- C. Clean exposed metal surfaces with mild cleaning agents.

**SECTION 12 2400
ROLLER WINDOW SHADES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Window shades and accessories.
- B. Manual and Electric motor operators.
- C. Motor controls.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.
- B. Section 09 2116 - Gypsum Board Assemblies: Substrate for window shade systems.
- C. Section 09 5100 - Acoustical Ceilings: Shade Pockets, pocket closures and accessories.
- D. Division 26 - Electrical: For interface with building electrical system.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
 - 2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
- B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of all affected installers.
- C. Sequencing:
 - 1. Do not fabricate shades until field dimensions for each opening have been taken.
 - 2. Do not install shades until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures, for submittal process.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
 - 1. Motorized Shades: Include power requirements and standard wiring diagrams.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details.
- D. Shop Drawings - Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.
- E. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.
- F. Selection Samples: Include fabric samples in full range of available colors and patterns.
 - 1. Motorized Shades: Include finish selections for controls.
- G. Verification Samples: Minimum size 6 inches (150 mm) square, representing actual materials, color and pattern.
- H. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

- I. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.
- J. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience.
 - 1. Factory training and demonstrated experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

1.08 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
 - 1. Shade Hardware: One year.
 - 2. Electric Motors: One year.
 - 3. Electronic Control Equipment: One year.
 - 4. Fabric: One year.
 - 5. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manually Operated Roller Shades (**WT-1**) and (**WT-2**): At all exterior windows not designated to receive motorized roller shades.
 - 1. Basis of Design: Draper, Inc: www.draperinc.com/#sle.
 - 2. SWFcontract, a division of Springs Window Fashions, LLC.; _____: www.swfcontract.com/#sle.
 - 3. MechoShade Systems, Inc..
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 WINDOW SHADE APPLICATIONS

- A. Refer to plans for shade types and locations.
 - 1. Type: Single Roller Shade
 - a. Basis of Design Fabric: UV 3% Open Fabric, Mecho Thermoveil.
 - b. Color: As indicated in Finish Key, or as selected by Architect from manufacturer's full range of colors.
 - c. Mounting: Per details in Drawings.
 - d. Operation: Manual.
 - 2. Type: Dual Roller Shade.
 - a. Fabric 1: UV 3% Open Fabric, Mecho Thermoveil, Blackout Fabric, Mecho Chelsea Blackout.
 - b. Color: As indicated in Finish Key, or as selected by Architect from manufacturer's full range of colors.

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- c. Mounting: Per details in Drawings.
- d. Operation:
 - 1) Manual in _____ and _____ lower windows only

2.03 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: Nickel-plated metal.
 - a. Loop Length: Extend to within 36 inches above finished floor.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Chain tensioner, sill-mounted or mounted on vertical window mullion, as applicable.
 - 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.
- 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. Roller Drive-End Location: Right side of inside face of shade, unless otherwise indicated on Drawings.
 - 2. Direction of Shadeband Roll: Regular, from back of roller.
 - 3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.
- 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: Light-filtering fabric.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
- E. Installation Accessories:
 - 1. Wall-Mount Angle Support Angles: Manufacturer's standard design for support of concealed roller window shade operating mechanism to be installed above finish ceiling as indicated on the Drawings.

2.04 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. Black-out Shade Fabric: 100% polyester fabric with acrylic foamed coating and anti-microbial finish.
- C. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 - 1. Source: Roller-shade manufacturer.
 - 2. Type: PVC-coated polyester, unless otherwise indicated in the Drawing "FINISH KEY."
 - 3. Roll Width: Maximum available by manufacturer, but not less than 84 inches.
 - 4. Openness Factor: 3 percent, unless otherwise indicated in the Drawing "FINISH KEY."
 - 5. Colors: As selected from Manufacturer's Full Range

2.05 ACCESSORIES

- A. Fascias: Size as required to conceal shade mounting.
 - 1. Style: As selected by Architect from shade manufacturer's full selection.
 - 2. Material and Color: To be selected by Designer from shade manufacturer's full range.

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- B. Brackets and Mounting Hardware: As recommended by manufacturer for mounting configuration and span indicated.
- C. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

2.06 FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Fabricate shades to fit openings within specified tolerances.
 - 1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch (13 mm) space between bottom bar and window stool.
 - 2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
- C. Dimensional Tolerances: As recommended in writing by manufacturer.
- D. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Installation Tolerances:
 - 1. Maximum Offset From Level: 1/16 inch (1.5 mm).
- C. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
- D. Adjust level, projection and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 SYSTEM STARTUP

- A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.
- D. Training: Train Owner's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.07 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

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**SECTION 12 3600
SIMULATED STONE COUNTERTOPS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

- A. Section 13 4273 - Integrated Interior Assemblies.

1.03 REFERENCE STANDARDS

- A. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- B. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- C. PS 1 - Structural Plywood; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures, for submittal process.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- F. Installation Instructions: Manufacturer's installation instructions and recommendations.
- G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Solid Surfacing Materials (**SSM-1** and **SSM-2**): Solid surfacing sheet or plastic resin casting over continuous substrate. To be used for countertops and wall applications as indicated in Drawings.
 - 1. Flat Sheet Thickness: 1/2 inch (12 mm); locations as indicated on drawings.
 - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.

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- a. Color and Pattern: As indicated on drawings.
- b. Manufacturers:
 - 1) **Basis of Design (SSM-1)** - Duresein, www.durasein.com
 - 2) **Basis of Design (SSM-2)** - Wilsonart, LLC[<>]: www.wilsonart.com
 - 3) Corian [<>]: www.corianquartz.com
 - 4) Formica Corporation: www.formica.com.
 - 5) Livingstone: www.livingstonesurfaces.com.
 - 6) Or prior approved equal.
3. Other Components Thickness: 1/2 inch (12 mm), minimum.
4. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high, unless otherwise indicated.
5. Miter Corners

2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, clear, unless indicated otherwise.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 1. Join lengths of tops using best method recommended by manufacturer.
 2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 2. Height: 4 inches (102 mm), unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. 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 counterop, form seams to comply with

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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.
- B. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 8 feet (___ mm in __ m), maximum.
- B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.
- C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**SECTION 21 1300
FIRE PROTECTION**

PART 1 - GENERAL

1.01 SCOPE

- A. Requirements of Section 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.
- B. Provide labor and materials, tools and appliances, and miscellaneous accessories to provide a complete and fully functional automatic sprinkler system throughout the building as shown on drawings and as required by the locally adopted codes and standards including, but not limited to, the National Fire Protection Association (NFPA) Standards, the International Building Code, etc.
- C. Coordinate all tamper switches, flow switches, pull stations, smoke detector, etc with fire alarm contractor. Refer to Section 28 3111 for electrical work associated with this Section.
- D. All sprinkler piping shall be concealed in the building. Dry type sidewall or pendent heads shall be used for overhangs, soffits, etc.
- E. All sprinkler system components shall be protected from damage and freezing conditions. If a dry system, pre-action system, etc. is proposed, the contractor shall provide all necessary power, control conduits, wiring, components, and accessories for a fully functional system.

1.02 SYSTEM DESCRIPTION

- A. The Sprinkler System shall provide coverage for the entire building. Switches for supervision with an approved central station are required.
- B. The building(s), within the scope of work of this project, shall be protected by a wet pipe system as follows:
 - 1. Light Hazard Areas: provide a density of 0.10 gpm/sq.ft. over the hydraulically most remote 1,500 sq.ft. of floor area plus hose allowance and coverage per sprinkler based on NFPA 13 requirements.
 - 2. Ordinary Hazard Group 1 Areas: provide a density of 0.15 gpm/sq.ft. over the hydraulically most remote 1,500 sq.ft. of floor area plus hose allowance and coverage per sprinkler based on NFPA 13 requirements.
 - 3. Ordinary Hazard Group 2 Areas: provide a density of 0.20 gpm/sq.ft. over the hydraulically most remote 1,500 sq.ft. of floor area plus hose allowance and coverage per sprinkler based on NFPA 13 requirements.
 - 4. Extra Hazard Group Areas: provide a density of 0.35 GPM/Sq. Ft. over 3000 square feet plus hose allowance and coverage per sprinkler based on NFPA 13 requirements.
 - 5. Storage Areas: provide sprinkler density/area coverage plus hose allowance for areas including, but not limited to, low-pile, high-pile, high-pile, high-rack, etc., based on NFPA 13 requirements.
- C. Contractor shall request the hydrant flow test report generated during design and available from the Architect. The Contractor shall conduct a new fire hydrant flow test as a basis for hydraulically calculated systems. The test shall be within 12 months from date of fire protection system submittal submission. The Contractor shall request the flow test requirements from the Architect.
- D. The Contractor shall request the signed Owner's Information Certificate from the Architect.

1.03 SUBMITTALS

- A. Contractor shall submit shop drawings, product data and hydraulic calculations to Architect/Engineer (A/E) for review and approval prior to issuing submittal to the Authority Having Jurisdiction and/or the Office of State Fire Marshal (OSFM) for approval. The State Fire Marshal Information Management System (OSFM-IMS) website shall only be used to upload

submittals that have the POR final review stamp with no additional comments or exceptions taken.

- B. Refer to Division 01 - Submittal Procedures for submittal requirements. The following paragraphs are an extension of Division 01 - Submittal Procedures.
- C. Review of shop drawings shall in no way modify the contract or relieve the Contractor from compliance with the contract.
- D. When electronic submittals are allowed, the Contractor shall also provide to the Architect a minimum of 3 hard copies of the submittal for all submittals that are greater than 25 pages or have a single sheet that is larger than 11" by 17".
- E. Names of manufacturers or catalog numbers are listed in the Specification in order to establish a standard for the type, general design and quality of the product required. Where "or approved equal" is indicated, other products similar in design and of equal quality and complying with the Drawings and Specifications will be considered for acceptance. See Division 01 – Substitution Procedures.
- F. Shop Drawings: Indicate detailed pipe layout, supports, components, accessories, sizes and hydraulic calculations.
- G. Product Data: Provide data for pipe materials used, valves, manufacturer's catalogue sheet for equipment, indicating rough-in-size, finish, accessories, pump type, capacity, power requirements, certified pump curves and NPSH.
- H. Operation and Maintenance Instructions: Include components of system, servicing requirements, Record Drawings, inspection data and parts lists.
- I. Extra Materials: Provide extra sprinkler heads per NFPA requirements for each type of sprinkler, wrenches and metal storage cabinet.
- J. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements.
- K. Any permits for the installation or construction of all work included in this section which are required by any of the authorities and/or agencies having jurisdiction shall be obtained and paid for by the Contractor.

1.04 QUALITY ASSURANCE

- A. Sprinkler Systems: Conform to NFPA 13.
- B. Fire Main: Conform to NFPA 24.
- C. Equipment and Components: Bear UL and FM label or marking as required.
- D. Specialist Firm: Company specializing in fire sprinkler protection systems whose supervisory personnel have a minimum of five years experience.
- E. Design: Under direct supervision of a NICET Level III designer.
- F. Drawings are diagrammatic. Obtain approval of the reviewing authority having jurisdiction (AHJ) before installing any part of the fire protection system. Contractor's bid shall be based on the contract documents and submission to the State Fire Marshal. Comply with all currently adopted codes and regulations including:
 - 1. City and State Fire Marshal.
 - 2. National Fire Protection Association (NFPA) including, but not limited to, NFPA 101 - Life Safety Code.
 - 3. International Building Code.
 - 4. Local Fire Rating Bureau.

1.05 ELECTRICAL

- A. Electrical valves, flow detectors, monitoring switches and other electrical devices provided under this section shall be connected with power sources as indicated under Section 28 3100. The electrical contractor shall purchase, install and tie-in the fire protection devices and

accessories to provide a complete operating fire protection system and assure the integrity of the complete system.

1.06 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect fire sprinkler system materials before, during and after installation and protect the installation work of all other trades.
- B. Suitable storage space as required shall be provided by the Owner to the Contractor. This space shall be agreed upon by the Owner and the Contractor prior to storage thereon.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 PIPE AND TUBE

- A. All piping shall be UL Listed and FM Approved for use in Fire Sprinkler System Applications.
- B. Steel Pipe:
 - 1. 2" dia. and smaller: ASTM A53, ASTM A120, ANSI/ASTM A135, or ANSI/ASME B36.10, Schedule 40 black or galvanized.
 - 2. 2-1/2" dia. and larger: ASTM A53, ASTM A120, ANSI/ASTM A135, or ANSI/ASME B36.10, Schedule 10 black or galvanized.
- C. Steel Fittings:
 - 1. ANSI/ASME B16.9, wrought steel, butt welded; ANSI/ASME B16025, butt weld ends; ASTM A234, wrought carbon steel and alloy steel; ANSI/ASME B16.5, steel flanges and fittings; ANSI/ASME B16.11, forged steel socket welded and threaded.
- D. Cast Iron Fittings:
 - 1. ANSI/ASME B16.1, flanges and fittings; ANSI/ASME B16.4, screwed fittings.
- E. Malleable Iron Fittings:
 - 1. ANSI/ASME B16.3, screwed type; ANSI/ASTM A47.
- F. Mechanical Grooved Couplings:
 - 1. Malleable iron housing, "C" shaped composition sealing gasket, steel bolts, nuts and washers; galvanized for galvanized pipe.
- G. All piping shall be securely fastened with UL approved hangers and hangers shall be in no case greater than twelve (12) feet apart. Every branch line length of pipe, except lengths less than eighteen (18) inches, shall have at least one hanger. Pipes shall be hung as follows: 1-1/4" @ 8'-0" on center, 1-1/2" to 3" @ 10'-0" on center, 4" to 8" @ 12'-0" center, and/or as required by NFPA 13.

2.02 GATE VALVES

- A. Up to and Including 2 Inches: Bronze body, body trim, rising stem, handwheel, inside screw, solid wedge or disc, solder or threaded ends.
- B. Over 2 inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, solid wedge, flanged or grooved ends.

2.03 BUTTERFLY VALVES

- A. Bronze body, stainless steel disc, resilient replaceable seat, threaded ends, extended neck, handwheel and gear drive and integral indicating device and built-in tamper proof switch.
- B. Cast or ductile iron body, chrome plated ductile iron disc, resilient replaceable EPDM seat, wafer or lug ends, extended neck, handwheel and gear drive and integral indicating device and built-in tamper proof switch.

2.04 CHECK VALVES

- A. Up to and including 2 inches: Bronze swing disc, solder or screwed ends.

- B. Over 2 inches: Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends.
- C. Iron body, bronze trim, stainless steel spring, renewable composition disc, screwed, wafer or flanged ends.

2.05 DRAIN VALVES

- A. Bronze compression stop with nipple and cap or hose thread.
- B. Brass ball valve.

2.06 SPRINKLER HEADS

- A. Manufacturers:
 1. Tyco Fire Protection Products.
 2. Viking Sprinklers.
 3. Victaulic Fire Sprinklers.
 4. Reliable Sprinkler.
 5. Or prior approved equivalent.
- B. Suspended Ceiling Type: Pendant type Tyco Model TY-FRI, Quick Response, Concealed Pendent Type Tyco Model RFII, Quick Response - or prior approved equal.
- C. Gypsum Ceiling Type: Concealed Pendent Type Tyco Model RFII, Quick Response - or prior approved equal.
- D. Exposed Area Type: Upright type Tyco Model TY-FRB, Quick Response, - or prior approved equal.

2.07 SPRINKLER PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with electrically or hydraulically operated alarms, with pressure retarded chamber and variable pressure trim and pressure gauges, Grinnell Model F200/F211, Star Model F or prior approved equal.
- B. Riser Control Valves: Riser control valve shall be equal to Grinnell Corp. Series 8000FP (2'-12" pipe), Star Model #380 or prior approved equal butterfly valve with integral supervisory switch.
- C. Water Gong: Water motor gong shall be equal to Grinnell Corp. Model F630 mechanical alarm or Star Model CD or prior approved equal.
- D. Flow Switches: Flow switches shall be vane type with retard, equal to Grinnell Corp. Model VSR-F (2"-8" pipe) or Star Part No. 1925-XS. Install to sound an audible alarm.
- E. Zone Control Valves: Sprinkler sectional or zone control valves shall be equal to Grinnell Corp. Model BB-SCS01 (2" and 2-1/2" pipe) with integral tamper switch or Central Butterfly Valve Model A-BFV-For larger pipe sizes use Grinnell Corp. Series 8000 FP butterfly valve with integral supervisory switch, Kennedy Fig. 93G1 or prior approved equal.
- F. Main Shut-Off valves: Main shut-off valves shall be gate iron body, bronzed trim solid wedge O.S. & Y, UL and FM, equal to Grinnell Fig. A-2073-6 or Kennedy Fig. 4068.
- G. Tamper Switches: switch for O.S.&Y valve shall be Grinnell Corp., OSYSU-2, Star Model No. OSY2 or prior approved equal, with contacts as required. Install to sound an audible alarm.
- H. Pressure Gauges: Approved 2-1/2" bronze Bourdon tube, Polycarbonate glass window in black steel case with brass cock. Select so normal pressure reads at center scale.
- I. Hangers and Supports:
 1. Individual hangers - Adjustable swivel ring, steel, zinc plated with rod secured to bracket screwed to beam.
 2. Riser clamps, 2 part steel, secured with 2 bolts, sized to clamp tight to pipe, wall supports, steel angle bracket secured to wall with hangers as above.
 3. All hangers and supports shall be UL approved.

2.08 FIRE DEPARTMENT CONNECTION

- A. Type: Flush mounted wall type with brass finish.
- B. Outlets: Two way thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
- C. Drain: inch automatic drip, to outside.
- D. Labels: Fire Department Connection for Sprinkler System.

PART 3 - EXECUTION

3.01 HYDRAULIC CALCULATIONS

- A. Contractor shall hydraulically calculate the sprinkler system using the format of NFPA 13. Necessary flow test shall be made on the City water supply prior to calculation. All variables and constants used shall be clearly defined. Shop drawings shall show the most remote area used in the calculations. Calculation should be submitted at the same time as the shop drawings. System sizing shall be based on an occupancy classification and required coverage per NFPA 13.
- B. The head locations shown on the drawings are diagrammatic and show the minimum number of heads anticipated. Should the contractor discover during the preparation of field measured shop drawings that any sprinkler heads require relocation, these changes should be made and incorporated into the shop drawings. Should it be determined because of obstructions, ceiling furring or partitions not shown, that additional heads are required for Code compliance, these shall be incorporated at no additional cost to the Owner.

3.02 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to commencement of each stage of the fire sprinkler system installation, carefully inspect the installed work of all other trades and verify that all such work is completed and correct to the point where this installation may properly commence.
 - 2. Avoid interferences with air conditioning ducts, lights, and mechanical and electrical piping and equipment. It is not the intent of drawings to show clearances.

3.03 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions and in strict accordance with all pertinent codes and regulations of the Fire Rating Bureau having jurisdiction.
- B. Ream pipe and tube ends to full inside diameter. Remove burrs and bevel plain end ferrous pipe.
- C. Remove scale and foreign material, inside and outside, before assembly.
- D. Provide sleeves when penetrating footings and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation required. An approved fire resistant compound, Dow-Corning Fire Stopper 2000, ProSet Fire Stop Systems or prior approved equal shall be used.
- E. Where any pipe or riser passes through walls, partitions, floors or ceilings, use chrome plated escutcheon plates. Plates shall be large enough to completely close the hole around the pipes and shall be round with the least dimension not less than 1-1/2" larger than the diameter of the pipe; caulk and secure in a manner approved by the Architect.
- F. Place pipe runs to minimize obstruction to other work. Place piping in concealed spaces above finished ceilings.
- G. Provide valves for shut-off or isolating service. Where approved, use butterfly valves instead of gate valves.
- H. Install main drains on main risers and auxiliary drains at low points in the system. Install inspector's test drains on each sprinkler system near to the outer end of the system. Five or fewer heads will not require a drain valve but may be drained through a plugged fitting. Drain valves to be of the angle type. Install in accordance with NFPA 13. Pipe drain valves to a safe place of discharge, visible either by open end drain pipe or sight drain fitting.

- I. Install on each system an inspector's test connection for the purpose of allowing an inspector to open inspector's test valve and prove that sprinkler system is operating correctly.
- J. Coordinate final location of Fire Department Connection, Standpipes, Hose Valves, etc. with the local authority having jurisdiction.
- K. Permanently marked, weatherproof, metal identification signs shall be provided for all control, drain, venting, and test connection valves and other components as required by NFPA Standards. These signs shall identify use and/or purpose of each component. The sign for the siamese connection shall read: "Auto-sprinkle". The control valve signs shall identify the portion of the building being served. Each system shall be given a numerical designation which will be displayed at the riser serving same and all signs for components on each system shall indicate system number. Systems that have more than one control valve that must be closed to work on a system or space shall have a sign referring to the existence and location of other valves.
- L. Upon completion of the sprinkler system installation, furnish all personnel and equipment required to test and re-test the complete system. However, isolate existing sprinklers being reused from pressure test. Make all adjustments necessary to secure the approval of the Fire Rating Bureau and Fire Marshal having jurisdiction. All piping to sprinkler heads shall be tested hydrostatically at the pressure of 200 psi for two (2) hours and proved tight. Notify Architect at least twenty-four (24) hours prior to the time of the test. Test shall be witnessed by Owner's Representative.

3.04 CLEANING

- A. When all work has been finally tested, Contractor shall clean all areas and spaces affected by his work.
- B. All finished, exposed products shall be thoroughly cleaned and/or polished.
- C. All piping shall be free from all obstructions.
- D. All crates, rubbish, etc., that is a result from this work shall be removed from the area on a daily basis.

3.05 ACCEPTANCE

- A. After the fire sprinkler system has been completely approved, secure a letter of final acceptance from the Fire Rating Bureau having jurisdiction and deliver three (3) copies of the letter to the Architect.

3.06 GUARANTEE

- A. Guarantee all materials and work for one year from the date of substantial completion. See "General Conditions".

END OF SECTION

SECTION 22 0500
COMMON WORK FOR HVAC, PLUMBING, AND FIRE PROTECTION

PART 1 - GENERAL

1.01 PROVISIONS

- A. Requirements of Section 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.
- B. Contents of this section shall be considered part of Section 01, Section 21, Section 22, and Section 23.

1.02 DESCRIPTION

- A. Work covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, permits, taxes, other items, and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawings.
- B. The Work described in this section of the specifications includes, but is not limited to, the following:
 - 1. Installation of chillers, air handling units, exhaust fans, VAV terminal units, centrifugal pumps, heating hot water boilers, ductwork, controls and devices required by drawings and specifications and required for a complete operable system.
 - 2. Chilled water piping and connections.
 - 3. Preparation for testing and balancing of mechanical systems and correcting deficiencies.
 - 4. Preparation and submittal of maintenance manuals, shop drawings, product data, and samples.
 - 5. Maintaining a record set of bond paper prints and marking them to indicate locations of concealed items, and deviations made to suit conditions and production of mechanical as-built (record) drawings.
 - 6. Bracing and anchoring equipment, sheet metal ducts, and piping systems.

1.03 RELATED WORK

- A. The following items of related work are specified and included in other sections of these specifications:
 - 1. Section 21 - Fire Suppression
 - 2. Section 22 - Plumbing
 - 3. Section 23 - Mechanical
 - 4. Section 26 - Electrical

1.04 JOB CONDITIONS

- A. Submittal of bid implies bidder has read applicable paragraphs of the specifications and will be bound by their conditions.
- B. Contractor Qualifications: Experience installing commercial cooling and heating systems, plumbing and piping systems similar to those described in these specifications.
- C. Contractor must be licensed and hold a current contracting license.
- D. Contractor must be able to bond work for performance of work being bid as stated in the Advertisement for Bids.

1.05 INTENT

- A. The contract documents (drawings, plans and specifications) describe the mechanical work of this project. Any item mentioned in one part shall be as binding as though mentioned in both.

- B. The contract documents form a guide for a complete and operable mechanical installation. Where an item is reasonably necessary but not specifically mentioned, such as duct hangers or transitions, piping offsets, drains, etc., for a complete system, provide same.
- C. Mechanical layouts indicated on drawings are diagrammatical only. Exact locations of ducts, pipes, and equipment shall be governed by the drawings of related trades.

1.06 DEVIATIONS

- A. No deviations from specifications and drawings shall be made without full knowledge and written consent of the Professional of Record (POR).
- B. During progress of work, existing conditions which dictate a modification of any particular requirement shall be promptly reported for a decision or instructions from the POR.

1.07 QUALITY ASSURANCE

- A. Contractor(s) shall comply with all applicable local, state, federal and municipal codes and regulations to protect the safety and health of employees and the public during construction.
- B. Comply with applicable requirements of recognized industry associations which promulgate standards for the various trades.
- C. Employ only qualified journeymen for this work. Employ competent, qualified mechanics to supervise the work.

1.08 CODES AND STANDARDS

- A. Perform work in accordance with codes and standards listed below, and such standards that may be specified in other sections. When these specifications are more stringent, they take precedence. In case of conflict, obtain a decision from the POR.
 - 1. NFPA: National Fire Protection Association
 - 2. 2021 International Mechanical Code
 - 3. 2021 International Building Code
 - 4. 2021 International Fuel Gas Code
 - 5. 2021 International Plumbing Code.
 - 6. ANSI Handicapped Code-A117.1.
 - 7. ANSI: American National Standards Institute.
 - 8. ARI: American Refrigeration Institute.
 - 9. ASHRAE: American Society of Heating Refrigeration and Air Conditioning.
 - 10. ASME: American Society for Mechanical Engineers.
 - 11. ASTM: American Society for Testing and Materials.
 - 12. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry
 - 13. NEMA: National Electrical Manufacturers' Association
 - 14. FPA: National Fire Protection Association.
 - 15. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association
 - 16. UL: Underwriters' Laboratories, Inc
 - 17. CISPI: Cast Iron Soil Pipe Institute
 - 18. Fire Marshal of the State of Louisiana
 - 19. Louisiana State Department of Health Services and Environmental Quality
 - 20. American Water Works Association (AWWA)
 - 21. OSHA: Occupational Safety and Health Administration
 - 22. EPA: Environmental Protection Agency

1.09 COORDINATION

- A. Carefully examine specifications and drawings to be thoroughly familiar with items which require plumbing or HVAC connections and coordination.
- B. Coordinate with other building trades to leave proper chases and openings. Place outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work.
- C. Layout the work and be responsible for its correctness. Take such measurements as may be necessary to assure approved fitting and proper installation of work, and all other work depending thereon.
- D. Arrange work in a neat, well-organized manner with exposed mechanical services (piping, ductwork, etc.) and similar services running parallel with primary lines of the building construction, high as possible with a minimum of 8'-0" overhead clearance or as directed by the Architect.
- E. Perform all work in the best and most substantial manner by workmen skilled in the work to be done. Provide adequate supervision at all times.
- F. Cooperate with other contractors to avoid complications between the installation of the various items of equipment. Advise other trades of openings required in their work for the subsequent move-in of large equipment.
- G. Where the method of installation is not certain, ask for details. Lack of details, not requested, will not be an excuse for improper installation, and any such work must be corrected.
- H. **Coordination Drawings:** For locations where several elements of mechanical or combined MEP work must be sequenced and positioned with precision to fit into the available space, prepare coordination drawings showing the actual physical dimensions (at accurate scale, minimum 1/4") required for the installation. Prepare and submit coordination drawings prior to purchase-fabrication-installation of any of the elements involved in the coordination.

1.10 SUBMITTALS

- A. Submit items to the POR. Submittals are only required for specific items of equipment or material listed in individual sections of these specifications and for equipment and devices scheduled on drawings.
- B. For specified manufacturers and model number equipment and devices, substitutions will be allowed by prior approval in accordance with Article 3.3 of the Instructions to Bidders.
- C. Refer to Division 01 - Submittal Procedures for submittal requirements. The following paragraphs are an extension of Division 01 - Submittal Procedures.
- D. Review of shop drawings shall in no way modify the contract or relieve the Contractor from compliance with the contract.
- E. When electronic submittals are allowed, the Contractor shall also provide to the Architect a minimum of 3 hard copies of the submittal for all submittals that are greater than 25 pages or have a single sheet that is larger than 11" by 17".
- F. Names of manufacturers or catalog numbers are listed in the Specification in order to establish a standard for the type, general design and quality of the product required. Where "or approved equal" is indicated, other products similar in design and of equal quality and complying with the Drawings and Specifications will be considered for acceptance. See Division 01 – Substitution Procedures.
- G. Shop Drawings: Submit shop drawings, including:
 - 1. Automatic temperature control system.
 - 2. Concrete pads and foundations including anchor bolt and sleeve locations.
 - 3. All new air handling units, hydronic heaters, fans and constant volume boxes.
 - 4. All new chilled water, hot water and condensate drain piping with valves, fittings, radiant heat panel and accessories.
 - 5. Brochures: Submit seven copies of manufacturer's brochures including:

- a. Complete descriptions
- b. Illustrations
- c. Specifications data of materials, and operating rates, etc
- d. Where items other than those proposed for use are illustrated and/or described on the same brochure pages, clearly indicate the items proposed for use
- e. Samples: Generally, samples will not be required, but if there is doubt on the part of the POR as to unit prepared for use, he may call for a sample. In that case, pay for packaging and transportation both ways. Item will remain the property of the submitter and may, if approved, be incorporated in the work.

1.11 OPERATING AND MAINTENANCE MANUALS

- A. Three sets of the following data are required:
 - 1. Operating and maintenance instructions
 - 2. Spare parts lists
 - 3. Copies of approved submittal data
 - 4. Equipment warranties
 - 5. Air balance report
 - 6. Arrange each set of data in an orderly way, and bind each set in a separate three-ring, hard cover binder in accordance with Section 01 requirements.
 - 7. As soon as data begins to accumulate, prepare one of the sets and deliver it to the POR. Continuously update that set as additional data is obtained.
 - 8. At completion of work, deliver two complete sets (in addition to set in A.3 above) to POR.

1.12 DELIVERY AND STORAGE

- A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where that is not practical, cover items with protective materials to keep them from being damaged. Use care in loading, transport, unloading, and storage to keep items from being damaged.
- B. Store items in a clean, dry place, and protect from damage.

1.13 WARRANTY

- A. Warranty all material, equipment, and workmanship for all sections under Sections 21, 22 and 23 in writing to be free from defects of material and workmanship for five (5) years from date of final acceptance by the POR or substantial completion, whichever occurs first. Replace without charge any material or equipment proving defective during this period. The warranty shall include performance of the equipment under all conditions of load, installing any additional items of control and/or protective devices as required, the replacement of any refrigerant lost, and providing chemical treatment as necessary as a result of services required due to system installation, performance, and equipment defects.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Within the Contract Documents relating to mechanical work, manufacturers' names, catalog numbers, and other proprietary references to materials and equipment are made. Such references are made to establish the standards of quality and type required, and not to limit competition. Most known or acceptable manufacturers of competitive products are listed in applicable sections as "approved equals". Reasonable requests for substitution or additions to "approved equals" will be considered, but the POR will be the sole judge of acceptability of items proposed as substitutes.
- B. Materials and equipment used in carrying out these specifications shall bear UL or other recognized testing laboratory label when such labels are available.

2.02 BASIC MATERIALS/METHOD

- A. Standard access doors, panels and frames: Style and type as required for material in which installed.
 - 1. Size: 18" x 18" minimum, as indicated, or as required to allow for maintenance service.
 - 2. Fourteen gauge minimum sheet metal for doors, 16 gauge frames of cadmium-plated or galvanized construction. Doors shall have expanded plaster rings where located in plaster walls or flanged finish where located in drywall or block construction.
 - 3. Panels shall have spring hinges with screwdriver locks in non-public areas. Key lock, keyed alike, for panels in public areas.
 - 4. Prime painted or rust inhibitive paint finish.
 - 5. UL labeled when in fire-rated construction, one and one half (1-1/2) hour rating.
 - 6. Provide in walls, floors, and ceilings to permit access to all equipment and piping requiring service or adjustment. Examples of such equipment needing access are dampers, mechanical system valves, and equipment needing periodic or replacement maintenance.
 - 7. Furnish and locate access panels under this Section. Coordinate with other trades who are responsible for building systems for which panels are to be installed.
 - 8. Manufacturers shall be Inland-Milcor, Bilco, Miami Carey, or approved equal. Use panels equal to Milcor Style M for masonry and drywall construction and equal to Milcor Style K for plastered masonry walls and ceilings. Stainless steel panels shall be used in ceramic tile or glazed structural tile.
- B. Security access doors, panels and frames: Style and type as required for material in which installed.
 - 1. For Walls and Ceilings
 - a. Size: 18" x 18" minimum, as indicated, or as required to allow for maintenance service.
 - b. Material: Steel or Stainless Steel: 10 gauge door, 2"x 2" x 3/16" angle frame
 - c. Door: 10 gage plate, flush to edge of frame
 - d. Frame: Flange to be 2" wide, mounting frame to have anchor straps
 - e. Hinge: Heavy duty butt hinges, welded to door and frame.
 - f. Latch: Detention type deadbolt lock with paracentric key. Also available: tamperproof security cam latches, cylinder lock and key. When master keying is required, doors can be prepared for rim or mortise cylinder locks.
 - g. Finish: Steel: 5 stage iron phosphate preparation with prime coat of white baked enamel.
 - h. Provide in walls, floors, and ceilings to permit access to all equipment and piping requiring service or adjustment. Examples of such equipment needing access are dampers, mechanical system valves, and equipment needing periodic or replacement maintenance.
 - i. Furnish and locate access panels under this Section. Coordinate with other trades who are responsible for building systems for which panels are to be installed.
 - j. Manufacturers shall be ACUDOR, Best Access Doors, or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. Visit the project site before bidding to determine existing conditions and assume all responsibility and bear all expenses in allowing for these conditions in the bid.
- B. No work shall be concealed until approved by the local inspector and all local regulations are adhered to.

- C. Mechanical drawings are diagrammatic except where dimensioned. Exact locations of ductwork, piping, and equipment may vary because of conflicts with work of other trades. Do not scale. Follow manufacturers certified shop drawings for accuracy. Unless noted as fixed, dimensions are based on the product of one (1) manufacturer. Verify dimensions with certified shop Drawings of the materials approved and purchased.
- D. Locate equipment requiring periodic servicing so that it is readily accessible. Do not back up service sides to walls, nor place it too close to other equipment to make service impractical.
- E. Upon completion, a certificate of approval from the appropriate regulatory agency shall be furnished to the Architect.
- F. Study all sections of the Specifications and Drawings. Notify Architect of conflict between Drawings and Specifications before bidding.

3.02 CUTTING AND PATCHING

- A. No structural members shall be cut without approval from the Structural Engineer.
- B. Repair or replace routine damage caused by cutting in performance of contract.
- C. Correct damage caused due to installation of mechanical work.
- D. Perform repairs with materials which match existing and install in accordance with the appropriate section of these specifications.

3.03 CONNECTION TO EQUIPMENT

- A. Connect or install equipment shown on mechanical drawings that requires plumbing and/or mechanical hookups.
- B. Rough-in piping and connect equipment.
- C. Provide piping, shutoff valves, and unions required for a complete and operable installation.

3.04 SERVICE OF SYSTEMS

- A. If equipment is placed in service prior to acceptance of the project by Owner, operate equipment strictly in accordance with manufacturer's instructions.
 - 1. Employ competent, qualified personnel in operation of the equipment.
 - 2. Provide for proper operation and cleanliness.
 - 3. Provide maintenance and repair of equipment, as required per manufacturer's recommendations, as necessary to maintain equipment warranty.
- B. Lubricate equipment and perform such other maintenance as required to place it in like-new operating condition.

3.05 ACCEPTANCE OF SYSTEMS

- A. Complete the following before requesting a final punch:
 - 1. Work required under this division of specifications except as permitted. Special attention shall be paid to completion of work required under Section 23 0630 – Cleaning Mechanical Systems.
 - 2. System balancing. Provide for "Substantial Completion" field observations.
 - 3. Control system checkout.
 - 4. Furnish required operating instructions, wiring diagrams, and electronic "project record document" control diagrams in accordance with Section 01 and provide one copy of each in the equipment rooms as specified elsewhere.
 - 5. POR will accept job on basis of tests and field observations. A representative of firm that performed test and balance work is to be in attendance to assist; and furnish necessary mechanics to operate system, make any necessary adjustments, and assist with close-out field observations and punch list.

3.06 TRAINING

- A. At a time agreed between the Owner and Contractor, provide training of the Owner's HVAC system operating personnel. This training shall be for a minimum 4 hour training sessions excluding travel time. The training shall be by a factory authorized and trained agent of the controls manufacturer. The training shall include, as a minimum, start-up, normal operation, set point adjusting, start-up after a power failure, and troubleshooting. Contractor shall provide establishment of Owner/Manufacturer interface for future system operation and maintenance support.

END OF SECTION

**SECTION 22 0529
HANGERS AND SUPPORTS FOR PLUMBING PIPING**

PART 1 - GENERAL

1.01 PROVISIONS

- A. Requirements of Section 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number to establish standards of quality and performance and not for the purpose of limiting competition.

1.02 DESCRIPTIONS

- A. Work covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawings.
- B. The work described in this section of the specifications includes but is not limited to the following:
 - 1. Pipe hangers for various types of pipe installed as set forth in this section and related sections.
 - 2. All intermediate support steel attached to building structure for piping systems as necessary for support of all piping systems.
- C. Piping shall be isolated from hanger material supports and different piping material shall be suitably isolated to prevent galvanic corrosion or deterioration resulting from contact of dissimilar metals.

1.03 RELATED WORK

- A. The following items of related work are specified and included in other sections of these operations from contact of dissimilar metals:
 - 1. Section 22 1116 - Domestic Water Piping
 - 2. Section 23 0719 - Mechanical System Insulation

1.04 SUBMITTALS

- A. Submit seven copies of manufacturer's product data for review by the Engineer.

PART 2 - PRODUCTS

2.01 APPLICABLE PUBLICATION

- A. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc. Publication are referenced in the text by the basic designation only.
 - 1. SP-58-93: Pipe Hangers and Supports - Materials, Design and Manufacturer.
 - 2. SP-69-91: Pipe Hangers and Supports - Selection and Application.

2.02 HANGERS

- A. Pipe hangers and supports. Adjustable clevis hangers for:
 - 1. Non-insulated pipe 2" through 24" diameter. Hanger material that is to be in direct contact with piping shall be compatible with pipe material to avoid dissimilar metal or galvanic corrosion.
- B. Pipe hangers and supports. Adjustable wrought clevis hangers, with SP-58, MSS Type 40 galvanized insulation protection shields (sized for supporting insulation having a compressive strength of 4 psi, at 8-foot intervals). Support piping on outside of insulation. Size hangers so that pipe insulation passes through them without interruption. Use these for:
 - 1. Insulated steel pipe 1/2" through 24" diameter.
 - 2. Insulated copper pipe 1/2" through 8" O.D.

- C. MSS SP-58 Type 6, with adjustable swivel ring, split ring type for:
 - 1. Non-insulated steel pipe, copper pipe 1/2" through 1-1/2" diameter.
- D. MSS SP-58 Type 9, with adjustable wrought tubing ring hanger, either plastic covered or copper plated for non-insulated copper tubing with no longitudinal movement.
- E. MSS SP-58 Type 41 with pipe roller and MSS SP-58 Type 40 galvanized insulation protection shields (sized for supporting insulation having a compressive strength of 4 psi, at 8-foot intervals). Support piping on outside of insulation. Size hangers so that pipe insulation passes through them without interruption. Use these for:
 - 1. Insulated copper pipe, 1/2" through 2" diameter, having longitudinal movement.
 - 2. Insulated steel pipe, 1" through 30" diameter, having longitudinal movement.
- F. MSS SP-58 Type 8, riser clamps (at floor slab penetrations) to support copper pipe risers.
- G. MSS SP-58 Type 8, riser clamps (at floor slab penetrations) to support steel pipe risers.
- H. Where three or more lines of pipe run parallel, support them with trapeze hangers.

PART 3 - EXECUTION

3.01 PIPE HANGERS

- A. Support pipes on specified hangers so that equipment, pumps, and fittings do not bear weight of pipe.
 - 1. Support pipe risers at regular intervals in pipe shafts in accordance with good practice.
 - 2. Do not use perforated metal, strap iron, or band iron.
 - 3. Do not make offsets in hangers.
- B. The maximum allowable spacing of pipe hangers is listed below. Space hangers and brackets at close intervals where necessary to maintain levels, slopes, and drainage, or to prevent sagging.
- C. Steel Pipe:
 - 1. 1/4" to 3/4" - 6'-0" o.c.
 - 2. 1" to 12" - 10'-0" o.c.
 - 3. 3/8 to 1 1/4" - 7'-0" o.c.
 - 4. 1 1/2 to 2" - 9'-0" o.c.
 - 5. 2 1/2 to 3" - 11'-0" o.c.
 - 6. 4" - 14'-0" o.c.
 - 7. 5" to 6" - 16'-0" o.c.
 - 8. 8" - 19'-0" o.c.
 - 9. 10" - 22'-0" o.c.
- D. Copper Pipe:
 - 1. 1/2" to 3/4" - 5'-0" o.c.
 - 2. 1" to 1-1/4" - 6'-0" o.c.
 - 3. 1 1/2" to 2" - 8'-0" o.c.
 - 4. 2 1/2 - 9'-0" o.c.
 - 5. 3" - 10'-0" o.c.
 - 6. 4" - 12'-0" o.c.
 - 7. 6" - 14'-0" o.c.
 - 8. 8" - 16'-0" o.c.

END OF SECTION

**SECTION 220553
MECHANICAL IDENTIFICATION**

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
 - 1. Adjust list below to suit Project.
 - 2. Equipment nameplates.
 - 3. Equipment markers.
 - 4. Equipment signs.
 - 5. Access panel and door markers.
 - 6. Pipe markers.
 - 7. Valve tags.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Certain items in this Specification are listed by manufacturer and/or manufacturer's model number to establish general style, type, character and quality of the product desired. Similar items manufactured by other than those listed will be considered, providing submittals are made according to Pre-Bid Approval requirements of Instructions to Bidders.
- B. Where no manufacturer or model number are given, any product meeting performance or design criteria, or referenced trade association standard may be used and Pre-Bid Approval is not required.
- C. Manufacturers: Subject to compliance with requirements for complete systems provide products of one of the following:

2.02 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
 - 1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 - 2. Location: Accessible and visible.
 - 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
 - 1. Terminology: Match schedules as closely as possible.
 - 2. Data:
 - a. Name and plan number.
 - b. Equipment service.

- c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
- 3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine sub core, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
 - 1. Data: Instructions for operation of equipment and for safety procedures.
 - 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
 - 3. Thickness: 1/8 inch, unless otherwise indicated.
 - 4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
 - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.03 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
 - 1. Colors: Comply with ASME A13.1, unless otherwise indicated.
 - 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
 - 3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360° around pipe at each location.
 - 4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
 - 5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pretensioned Pipe Markers: Pre-coiled semi rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semi rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.
- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.
 - 1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
 - 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

2.04 VALVE TAGS

- A. Valve Tags: Stamped or laser engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme. Provide 5/32-inch hole for fastener.
 - 1. Material: 0.032-inch- thick brass.
 - 2. Valve-Tag Fasteners: Brass wire-link or beaded chain

PART 3 - EXECUTION

3.01 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.02 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
 - 1. Fuel-burning units, including boilers, furnaces, heaters, and make up air units
 - 2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - 3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - 4. Fans, blowers, air handling units primary balancing dampers, and mixing boxes.
 - 5. Packaged HVAC central-station and zone-type units.
 - 6. Split system D/X and packaged D/X equipment
 - 7. Variable air volume (VAV) boxes – tags should be located on the underside of the ceiling.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
 - 1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 2. Locate markers where accessible and visible.
- C. Install access panel markers with screws on equipment access panels.

3.03 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
 - 1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.
 - 2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, 1-1/2 inches wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non concealed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and non-accessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.04 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; compressed air systems, all overhead reel systems, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:
 1. Valve-Tag Size and Shape:
 - a. 2 inches round or square with one 3/16" hole.
 2. Valve-Tag Color:
 - a. Brass Tag
 3. Letter Color:
 - a. High Contrast Black

3.05 ADJUSTING AND CLEANING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.
- B. Clean faces of mechanical identification devices.

END OF SECTION

**SECTION 22 1116
DOMESTIC WATER PIPING**

PART 1 - GENERAL

1.01 GENERAL

- A. All pipe, fittings, and pipe joining material used for potable water systems shall be lead free in accordance with state and federal regulations.

1.02 RELATED DOCUMENTS

- A. Requirements of Division 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.

1.03 SUMMARY

- A. This Section specifies the water distribution piping system, including potable cold, hot, water piping, fittings, and specialties within the building.
- B. Products installed but not furnished under this Section include water meters which will be provided by the Utility Company, to the site, ready for installation.

1.04 RELATED SECTIONS

- A. The following Sections contain requirements that relate to this Section.
- B. Refer to Civil specification for "Site Water Service Piping" for water service piping.
- C. Division 02 - "Earthwork" for trenching and backfilling materials and methods for underground piping installations.
- D. Division 07 - "Joint Sealers" for materials and methods for sealing pipe penetrations through basement walls and fire and smoke barriers.
- E. Division 23 - "Mechanical Identification" for labeling and identification of piping system.

1.05 DEFINITIONS

- A. Water Distribution Piping: A pipe within the building, or on the premises, which conveys water from the water service pipe, or meter, to the points of usage.
- B. Water Service Piping: The pipe from the water main, or other source of potable water supply, to the water distributing system of the building served.
- C. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).

1.06 SUBMITTALS

- A. Submit shop drawings, minimum of 1/4" scale, drawings shall be done in AutoCAD 2012 or later release. Shop drawings shall include pipe routing with elevations, dimensions, floor penetration locations. All systems shall be coordinated with structural, architectural and all other trades. Shop drawing includes piping for underground and above ground for all plumbing systems.
- B. Product data, including operation and maintenance data, for each piping specialty and valve specified.
- C. Welder's certificates certifying that welders comply with requirements specified in Quality Assurance below.
- D. Certification of Compliance with ASME and UL fabrication requirements specified below.
- E. Test reports specified in Part 3 of this specification.

1.07 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with the provisions of the following:
 - 1. ASME B 31.9 "Building Services Piping" for, materials, products and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.
 - 2. ASME "Boiler and Pressure Vessel Code," Section IX. "Welding and Brazing Qualification" for Qualifications for Welding Processes and Operators

- 3. Currently adopted International Plumbing Code and Standards.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with requirements of NSF/ANSI 61-G and NSF/ANSI 372 for potable domestic water piping, including valves specified in Division 23.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store pipe and fittings in a manner to prevent sagging and bending and as per manufacturer.
- B. Recommendation to be protected from direct sunlight.

1.09 SEQUENCING AND SCHEDULING

- A. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad. Refer to Division 03 for concrete and formwork requirements.
- B. Coordinate the installation of pipe sleeves for foundation wall penetrations.

1.10 EXTRA STOCK

- A. Maintenance Stock: Furnish one valve key for each key operated hydrant, bibb, or faucet installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Submit seven reproducible copies for review
 - 2. Basket Strainers:
 - a. Josam Mfg. Co.
 - b. Metraflex Co.
 - c. Mueller
 - d. Spirax Sarco
 - e. Smith (Jay R.) Mfg. Co.
 - 3. Balance Cocks:
 - a. American Air Filter Co.
 - b. Bell & Gossett ITT; Fluid Handling Div.
 - c. Hammond Valve Corp.
 - d. Milwaukee Valve Co., Inc.
 - e. Spirax Sarco
 - f. Taco, Inc.
 - 4. Bibbs and Faucets:
 - a. Chicago Faucet Co.
 - b. Hammond Valve Corp.
 - c. Mansfield Plumbing Products
 - d. Nibco Inc.
 - e. Watts Regulator Co.
 - 5. Hydrants:
 - a. Josam Mfg. Co.
 - b. Jay R. Smith Mfg. Co.
 - c. Wade/Tyler Pipe; Sub. of Tyler Corp.
 - d. Watts Drainage Products

- e. Woodford Mfg. Co.
- f. Zurn Industries Inc., Hydromechanics Div.
- 6. Backflow Preventers:
 - a. Febco Sales, Inc.: Subs. of Charles M. Bailey Co., Inc.
 - b. Hersey Products, Inc.
 - c. Watts Regulator Co.
 - d. Zurn Industries, Inc.; Wilkins-Regulator Div.
 - e. Vacuum Breakers
 - f. Watts Regulator Co.
 - g. Febco Sales, Inc.; Subs. of Charles M. Bailey Co., Inc.
 - h. Zurn Industries, Inc.; Willinr-Regulator Div.
- 7. Pressure Regulating Valves:
 - a. Cash (A. W.) Valve Mfg. Corp.
 - b. Cla-Val Co.
 - c. Spence Engineering Co., Inc.
 - d. Watts Regulator Co.
 - e. Automatic Flow Control Valves
 - f. Griswold Controls
- 8. Water Meters:
 - a. Badger Meter, Inc.
 - b. Hersey Products Inc.
 - c. Neptune Water Meter Co.: Subs. Neptune Int'l.
 - d. Rockwell Int'l. Municipal & Utility Div.
 - e. Zurn Industries Inc.; Hays Fluid Controls Div.
- 9. Relief Valves:
 - a. Cash (A. W.) Valve Mfg. Corp.
 - b. Conbraco Industries, Inc.
 - c. Watts Regulator Co.
 - d. Zurn Industries, Inc.; Wilkins-Regulator Div.
- 10. Water Hammer Arresters:
 - a. Amtrol, Inc.
 - b. Josam Manufacturing Co.
 - c. Jay R. Smith Mfg. Co.
 - d. Wade/Tyler Pipe; Sub. of Tyler Corp.
 - e. Watts Drainage Products
 - f. Zurn Industries, Inc.; Hydromechanics Div.
 - g. Sioux Chief Manufacturing Co., Inc.
 - h. Precision Plumbing Products, Inc)
- 11. Dielectric Couplings:
 - a. Merit Brass Company
 - b. Lochinvar Company (V-line)
- 12. Y-Pattern Strainers:

- a. Armstrong Machine Works
 - b. Hoffman Specialty ITT: Fluid Handling Div.
 - c. Metraflex Co.
 - d. Mueller
 - e. Spirax Sarco
 - f. Watts Regulator Co.
13. Press Fittings:
- a. Apollo
 - b. Viega
 - c. Nibco

2.02 PIPE AND TUBE MATERIALS

- A. Potable-water piping and components shall comply with NSF/ANSI 61 and NSF/ANSI 372 Standards.
- B. General: Refer to Part 3, Article Applications, for identification of systems where the below materials are used.
- C. Drawn tempered copper tubing: ASTM B88, Type L
- D. Annealed tempered copper tubing: ASTM B88, Type K
- E. Ductile iron pipe: ANSI A21.51 ductile iron pipe, with ANSI A21.4 cement mortar lining.
- F. Stainless-Steel Pipe: ASTM A 312/A 312M, Schedule 40.

2.03 FITTINGS

- A. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.
- B. Ductile-iron Gasketed Fittings: AWWA C110, Schedule 150, with cement mortar lining and AWWA C111 rubber gaskets.
- C. Press fittings: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or B16.22. O-rings for the copper press fittings shall be EPDM. Press fittings shall be as manufactured by Viega, LLC or prior approved equivalent.
- D. Grooved Mechanical Couplings: Consist of non-galvanized ductile or malleable iron housing, a synthetic rubber gasket of a central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings. Nuts and bolts shall be stainless steel.
- E. Cast-iron Threaded Flanges: ANSI B16.1, Class 125; raised ground face, bolt holes spot faced. Nuts and bolts shall be stainless steel.
- F. Cast Bronze Flanges: ANSI B16.24, Class 150; raised ground face, bolt holes spot faced. Nuts and bolts shall be stainless steel.

2.04 UNIONS, COUPLINGS and CONNECTORS

- A. Unions: ANSI B16.39, malleable iron, Class 150, hexagonal stock, with ball- and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends. Threads shall conform to ANSI B1.20.1.
- B. Dielectric couplings: Use dielectric couplers at junction of steel pipe and equipment with copper piping systems. Do not use steel or cast iron fittings in copper piping system. Brass fittings shall be used for dielectric locations. Provide brass dielectric flange kits at dissimilar metal flange connections.
- C. Flexible Connectors: Stainless steel bellows with woven flexible bronze wire reinforcing protective jacket; minimum 150 psig working pressure, maximum 250° F operating temperature. Connectors shall have flanged or threaded end connections to match equipment connected; and shall be capable of 3/4 inch misalignment.

2.05 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, 95-5 Tin-Antimony.
- B. J.W. Harris "Stay-safe 50" or equal 94.5% Tin - 0.5% Silver 3% Antimony - 1.5% Zinc 0.5% Copper.
- C. Brazing Filler Metals: AWS A5.8, BCup-4 6% silver for joints below ground.
- D. Copper Pipe: 2-1/2 inches and larger; (TIG) Gas Tungsten arc welding.
- E. Gasket Material: Thickness, material, and type suitable for fluid to be handled, and design temperatures and pressures.

2.06 GENERAL DUTY VALVES

- A. Valves (i.e., gate, globe, check, ball, and butterfly valves) are specified in Division 23 Section "Valves." Special duty valves are specified below by their generic name; refer to Part 3 Article "VALVE APPLICATION" for specific uses and applications for each valve specified.

2.07 SPECIAL DUTY VALVES (NOT USED)

2.08 COPPER-ALLOY CALIBRATED BALANCING VALVES

- 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. Armstrong International, Inc.
 - 2. ITT Industries; Bell & Gossett Div.
 - 3. NIBCO INC.
 - 4. Watts Industries, Inc.; Water Products Div.
 - 5. Or prior approved equal.
- B. Type: Ball valve with two readout ports and memory setting indicator.
- C. Body: Brass
- D. Size: Same as connected piping, but not larger than NPS 2.
- E. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.09 THERMOSTATIC MIXING VALVES

- A. Tempered water shall be delivered from lavatories and group wash fixtures located in public toilet facilities provided for customers, patrons, and visitors. Tempered water shall be delivered through an approved water-temperature limiting device that conforms to ASSE 1070/ASME A112.1070

2.10 PIPING SPECIALTIES

- A. Water Hammer Arresters: Water hammer arresters shall be sized, tested and certified in accordance with PDI Standard WH-201, A.S.S.E.-1010 and A.N.S.I.-A112.26.1.
- B. Spun closed, one-piece, seamless type 'L' copper tube and factory charged, with acetal piston, three EPDM O-rings, pressure-lubricated with Dow Corning III silicone compound, FDA approved. Unit shall be pressure rated for 250 psi, designed to keep waterline at 150 psi working pressure during pressure surges following quick valve closure. Working temperature from 33° F to 250° F
OR
- C. Constructed of all stainless steel and with internal heavy duty balanced expansion bellows, pre-charged suitable for operation in temperature range of minus 100 to 300 degrees F and maximum 250 psig working pressure.

2.11 REACTION ANCHORS

- A. Provide concrete thrust blocking or joint harness for all pressure piping in accordance with NFPA 24.

- B. Thrust blocking: Sufficient mass of concrete, bearing on solid undisturbed earth, to resist hydraulic thrust at maximum pressure to which pipe will be subjected, 150 psi minimum.
- C. Joint harness: Steel straps and rods across joints, securely anchored on pipe or other adequate anchorage to resist hydraulic thrust at maximum pressure to which pipe will be subjected, 150 psi minimum.
 - 1. Coal tar coating: Koppers Bitumastic type 50.
 - 2. Clamps, straps, and washers: steel, ASTM A506.
 - 3. Rods: Steel, ASTM A575
 - 4. Rod coupling: Malleable iron
 - 5. Bolts: Steel, ASTM A307
 - 6. Cast iron washers: Gray iron ASTM A126

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design and the referenced standards.
- B. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation.
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PIPE APPLICATIONS

- A. Install Type L, drawn copper tubing with wrought copper fittings and solder joints for 4 inch and smaller above ground, within building. At the Contractor's option, install Type L, drawn copper tubing with wrought copper press fittings in accordance with the manufacturer's recommendations for 2 inch and smaller above ground within building.
- B. Install Type K, annealed temper copper tubing for 2 inch and smaller with no joints, below ground.
- C. Unless otherwise noted, install cement-lined ductile-iron pipe with rubber gasket joints below ground, inside and outside the building.

3.03 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.
- B. Use fittings for all changes in direction and all branch connections.
- C. Branch connections shall be made from the side or bottom of the main to facilitate drainage.
- D. Install exposed piping, at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- E. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- F. Install pipe tee fittings in a manner that avoids bullhead flow conditions. Refer to drawing details for prohibited bullhead tee piping configurations.
- G. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- H. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building.
- I. Provide space to permit insulation applications, with 1 inch clearance outside the insulation.

- J. Allow sufficient space above removable ceiling panels to allow for panel removal.
- K. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- L. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4 inch ball valve, and short 3/4 inch threaded nipple and cap.
- M. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel: pipe sleeves 6 inch and larger shall be sheet metal.
- N. Fire Barrier Penetrations: Where pipes pass through time rated fire restive construction including fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division-7 for special sealers and materials.
- O. Install piping level with no pitch.

3.04 HANGERS AND SUPPORTS

- A. Refer to Section 22 05 29

3.05 PIPE AND TUBE JOINT CONSTRUCTION

- A. Soldered Joints: Comply with the procedures contained in the AWS "Soldering Manual."
 - 1. CAUTION: Remove stems, seats, and packing of valves and accessible internal parts of piping specialties before soldering.
 - 2. Heat joints to proper and uniform temperature.
- 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 (except where dry seal threading is specified).
 - 4. Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.
- C. Damaged Threads: Do not use pipe with threads which an corroded or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.
- D. Flanged Joints: Align flanged surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible.
 - 1. Use suitable lubricants on bolt threads.
 - 2. Tighten bolts gradually and uniformly using torque wrench.
- E. PVC Pipe fittings: No PVC pipe allowed.

3.06 SERVICE ENTRANCE

- A. Extend water distribution piping to connect to water service piping of size and in location indicated for service entrance to building. Coordinate with civil site work for additional site construction requirements.
- B. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation.
- C. Install shutoff valve at service entrance inside building, complete with strainer, pressure gage, and test tee with valve.
- D. Ductile-iron Pipe: Install in accordance with AWWA C-600, manufacturer's recommendations, and the currently adopted codes and standards. For underground piping installations, the contractor shall request a soil-test evaluation and report to determine job-site soil

characteristics. Contractor shall provide pipe encasement in accordance with ANSI/AWWA C105/A21.5, as required, to protect the underground pipe and reduce the rate of corrosion.

- E. Reaction anchors: Use concrete thrust blocking where solid undisturbed earth is available. Use joint harnesses in other places. If lack of undisturbed earth is the result of improper trench excavation, provide joint harness at no additional cost. Coat underground metal surfaces not encased in concrete with two coats of Koppers Bitumastic Type 50. Bitumastic shall be applied to clean dry surfaces only. Allow the first coat to dry before applying second coat.

3.07 VALVE APPLICATIONS

- A. General Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated the following requirements apply:
 - 1. Shut-off duty: Use gate, ball, and butterfly valves.
 - 2. Throttling duty: Use ball and butterfly valves.
 - 3. Hot water return balancing: Use Thermostatic Balance valves.

3.08 INSTALLATION OF VALVES

- A. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated. For sectional valves 2 inch and smaller, use gate or ball valves; for sectional valves 2-1/2 inch and larger, use gate or butterfly valves.
- B. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated. For shutoff valves 2 inch and smaller, use gate or ball valves; for shutoff valves 2-1/2 inch and larger, use gate or butterfly valves.
- C. Drain Valves: Install drain valves on each plumbing equipment item, located to completely drain equipment for service or repair. Install drain valves at the base of each riser, at low points of horizontal runs, and elsewhere to completely drain distribution piping system. For drain valves 2 inch and smaller, use gate or ball valves; for drain valves 2-1/2 inch and larger, use gate or butterfly valves.
- D. Check Valves: Install swing check valves on discharge side of each pump, and elsewhere as indicated.
- E. Balance Cocks: Install in each hot water recirculation loop, the discharge side of each pump, and elsewhere as indicated.

3.09 VALVE ACCESS

- A. Locate shut off and control valves for easy access and operation. Refer to Division 08 for access door requirements.

3.10 INSTALLATION OF PIPING SPECIALTIES

- A. Install backflow prevention assemblies (BPA) at make-up water connection to mechanical equipment and systems, and in compliance with the currently adopted International Plumbing Code (IPC) and the Authority Having Jurisdiction (AHJ). Refer to contract drawings for general location of BPA. The AHJ shall approve the type of backflow prevention assembly or method required for cross-contamination containment based on the requirements of IPC (Table 608.1) and the degree of hazard. If a cross-connection is not listed, the Water Purveyor shall use the "Manual for the Selection, Installation, Maintenance, and Field Testing of Backflow Prevention Devices" (CAN/CSA Standard B64.10) as a guide to determine the type of devices and testing procedures required.
- B. Install pressure regulating valves with inlet and outlet shutoff valves, and balance cock bypass. Install pressure gage on valve outlet.
- C. Size and Locate Water Hammer Arresters in accordance with the following schedule, and located within an effective range of the quick-closing valve as per the requirements of Standard PDI-WH2O1 current edition, whether shown or not shown on the drawings.

3.11 WATER HAMMER ARRESTER SCHEDULE

MARK	I.P.S.	F.U. RATING	J.R. SMITH NO	WADE NO	ZURN NO.
'A'	1/2"	1-11	SC500	W-5	100
'B'	3/4"	12-32	SC750	W-10	200
'C'	1"	33-60	SC1000	W-20	300
'D'	1 ¼ "	61-113	SC1250	W-50	400
'E'	1 ½ "	114-154	SC1500	W-75	500
'F'	2"	155-330	SC2000	W-10	600

All water hammer arresters shall be P.D.I. certified.

3.12 EQUIPMENT CONNECTIONS

- A. Supplies and Trim: All supplies, including but not limited to, hardware, trim, and traps to fixtures and equipment shall be chrome plated brass if exposed.
- B. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Plumbing Code.
- C. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated. Provide shutoff valve and union for each connection. Provide drain valve on drain connection. For connections 2-1/2" and larger, use flanges instead of unions.

3.13 FIELD QUALITY CONTROL

- A. Inspections: Inspect water distribution piping as follows:
 - 1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction and by the Professional of Record.
 - 2. During the process of the installation, notify the Professional of Record at least 72 hours prior to the time such inspection must be made.
 - 3. Perform tests specified below in the presence of the plumbing official.
- B. Rough-in Inspection: Arrange for inspection of the piping system before being concealed or closed-in after system is roughed-in, and prior to setting fixtures.
- C. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
- D. Re-inspections: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and notify the Professional of Record to arrange for re-inspection by the plumbing official.
- E. Reports: Prepare inspection reports, signed by the plumbing official and submit a copy to the Professional of Record.
- F. Test water distribution piping as follows:
 - 1. Test for leaks and defects all new water distribution piping systems and parts of existing systems which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
 - 2. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.
 - 3. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for a period of no less than 4 hours. Leaks and loss in test pressure constitute defects which must be repaired.

4. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
5. Prepare reports for all tests and required corrective action.

3.14 ADJUSTING AND CLEANING

- A. Clean and Disinfect water distribution piping as follows:
 1. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use.
 2. Hot water piping shall be sterilized with cold water, not heated.
 3. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction, or in case a method is not prescribed by that authority, the procedure described in either AWWA C651, or AWWA D105 or as described below:
 - a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
 - b. Fill the system or part thereof, with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system, or part thereof, and allow to stand for 24 hours.
 - c. Drain the system, or part thereof, of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
 - d. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming for the system.
 - e. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.
- B. Prepare reports for all purging and disinfecting activities.
- C. The Contractor shall be solely responsible for the final delivery of the potable water system approved by the Louisiana State Department of Health & Hospitals.

3.15 COMMISSIONING

- A. Fill the system.
- B. Check compression tanks to determine that they are not air bound and that the system is completely full of water.
- C. Before operating the system perform these steps:
 1. Open valves to full open position. Close drain, valves, hydrants, and sill cocks.
 2. Remove and clean strainers.
 3. Check pump for proper direction of rotation. Make any necessary corrections.
- D. Lubricate pump motors and bearings.

END OF SECTION

**SECTION 22 1413
DRAINAGE AND VENT PIPING SYSTEMS**

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Requirements of Section 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.

1.02 RELATED SECTIONS

- A. The following Sections contain requirements that relate to this Section.
 - 1. Section 02 for trenching and backfilling materials and methods for underground piping installations.
 - 2. Section 07 for materials and methods for sealing pipe penetrations through basement walls and fire and smoke barriers.
 - 3. Section 08 for access doors in finished architectural walls, floors and ceilings.
 - 4. Section 22 for labeling and identification of piping system.

1.03 SUBMITTALS

- A. Product data for the following products:
 - 1. Drainage piping specialties
 - 2. Drainage pipe and fittings
 - 3. Floor drains
- B. Operation and Maintenance data for each piping specialty specified as required in Section 01.
- C. Inspection reports specified in Part 3 of this Section.
- D. Test reports specified in Part 3 of this Section.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with the provisions of the following:
 - 1. Currently adopted International Plumbing Code and Standards.
 - 2. Requirements of the Plumbing Official or the Authority Having Jurisdiction.
 - 3. Piping materials shall bear labels, stamps, and markings of the manufacturer or testing agency.

1.05 SEQUENCING AND SCHEDULING

- A. Coordinate the installation of drain flashing and roof penetrations.
- B. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.
- C. Coordinate with installation of sanitary sewer systems as necessary to interface building drains with drainage piping systems.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide drainage and vent systems components from one of the following:
 - 1. Pipe and Fittings:
 - a. Charlotte Pipe and Foundry Company or prior approved equivalent.

2. Drainage Specialties including, but not limited to, backwater valves, expansion joints, and vandal-proof vent caps, etc.:
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Mfg. Co.
 - c. Wade/Tyler Pipe; Subs. of Tyler Corp.
 - d. Watts Drainage Products
 - e. Zurn Industries Inc.; Hydromechanics Div.
3. Floor drains:
 - a. Jay R. Smith Co.
 - b. Josam Mfg. Co.
 - c. Wade/Tyler Pipe; Subs. of Tyler Corp.
 - d. Watts Drainage Products
 - e. Zurn Industries, Inc.

2.02 BELOW GROUND SANITARY AND VENT PIPE AND FITTINGS (INCLUDING GREASY WASTE)

- A. Standard Service Hub and Spigot Cast Iron Soil Pipe and Fittings: Standard Service Cast Iron pipe and fittings shall be manufactured from gray cast iron with a tensile strength of not less than 21,000 psi. Compression gaskets shall be manufactured from an elastomer meeting the requirements of ASTM C564. Pipe and fittings shall comply with CISPI Standard 301, ASTM A888 or ASTM A-74. All pipe and fittings shall be made in the United States and marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF® International. All pipe and fittings shall be of the same manufacturer. Provide products by Charlotte Pipe and Foundry Co. or prior approved equivalent.
- B. Solid wall, Schedule 40, PVC piping, ASTM D 2665, can be used as an alternative in applications where the liquid temperature will not exceed 110°F. Foam/Cellular Core PVC piping is not acceptable.
- C. Stainless Steel Type 316L, ASME A112.3.1, piping and fittings can be used as an alternative.
- D. See Section 3.03 for hangers and supports requirements.

2.03 ABOVE GROUND SANITARY AND VENT PIPING AND FITTINGS

- A. Hubless Cast-Iron Soil Pipe: All waste lines and fittings shall conform to the requirements of CISPI Standard 301, ASTM A888 or ASTM A-74. Compression gaskets shall be manufactured from an elastomer meeting the requirements of ASTM C564. All pipe and fittings shall be made in the United States and marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF® International. All pipe and fittings shall be of the same manufacturer. Provide products by Charlotte Pipe and Foundry Co. or prior approved equivalent.
 1. Joints for hubless sanitary pipe and fittings shall conform to the manufacturer's installation instructions and local codes requirements. Hubless couplings shall conform to CISPI 310, FM CN 1680 Class 1, ASTM C564, ASTM C1277, ASTM C1540, IAPMO File #3198 and #6726 for heavy-duty applications.
 2. Joints for hubless vent pipe and fittings shall conform to the manufacturer's installation instructions and local codes requirements. Hubless couplings shall conform to CISPI 310, ASTM C564 and ASTM C1277, IAPMO File #3198 and #6726 for standard-duty applications.
- B. Solid wall, Schedule 40, PVC piping, ASTM D 2665, can be used as an alternative in areas where noise is not considered to be an issue. See Section 3.03 for hangers and supports requirements. Schedule 40, Foam Core, PVC piping is not acceptable.
- C. Stainless Steel Type 316L, ASME A112.3.1, piping and fittings can be used as an alternative.

2.04 DRAINAGE PIPING SPECIALTIES

- A. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.
- B. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.

C. Cleanouts:

1. Floor Cleanouts: Cast-iron body and frames or combination cast-iron/ABS body and frame; brass cleanout plug; nickel-bronze adjustable round top. Manufacturer's standard cast unit of pattern indicated as follows:
 - a. Pattern: Exposed flush type, standard non-slip scoriated finish; Jay R. Smith 4023. Nickel Bronze Round top.
 - b. Pattern: In carpeted areas, Polished Bronze flush type, standard non-slip scoriated finish, stainless steel carpet marker; Jay R. Smith 4023Y.
 - c. Pattern: In tile, Nickel Bronze, flush type, standard non-slip scoriated finish: Jay R. Smith 4143, round top.
 - d. Pattern: In terrazzo, Nickel Bronze, flush type, standard non-slip scoriated finish: Jay R. Smith 4183, round top.
2. Wall Cleanouts: Duco cast iron caulk ferrule with cast bronze taper threaded plug nickel bronze frame and polished bronze secured cover flush with wall like Jay R. Smith model 4435.

D. Floor drains:

1. General: Provide floor drains of size as indicated on drawings; and type, including features, as specified in Drawing P100 schedule.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.
- B. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.
- B. Refer to Division 08 for access door installation requirements.
- C. Use fittings for all changes in direction and all branch connections.
- D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- E. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- F. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- G. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Allow sufficient space above removable ceiling panels to allow for panel removal.
- H. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inch and larger shall be sheet metal.
- I. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Section 07 for special sealers and materials. All piping penetrations through fire rated walls shall be cast iron.
- J. Make changes in direction for drainage and vent piping using appropriate 45 degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction

of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back-to-back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

3.03 HANGERS AND SUPPORTS (INDOORS and OUTDOORS)

A. General: Hanger, supports, and anchors devices are specified in Section 22 0529 - Pipe Hangers. Conform to the following requirements for maximum spacing of supports.

1. Indoors:
 - a. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.
 - b. Unless otherwise noted, install hangers and supports at minimum intervals in accordance with the currently adopted Plumbing Code and Standards.
 - c. PVC pipe shall not be used to handle liquids exceeding 110°F. Provide stainless steel support hangers and rods at 2'-0' foot spacing with hangers at every joint and fitting. Furnish and install 1'-0" long, stainless steel, pipe saddles with every hanger for additional support.
2. Outdoor Piping Suspended from On-Grade Slabs:
 - a. Coordinate with civil engineer and refer to geotechnical report(s) for details on specific ground conditions and recommendations for installation of underground utilities.
 - b. Cast Iron and Stainless-Steel pipe:
 - 1) Provide stainless steel support hangers and rods at 2'-0' foot spacing with hangers at every joint and fitting. Furnish and install 1'-0" long, stainless steel, pipe saddles with every hanger for additional support. Provide flexible connections / swing joints at all exterior underground connections between pile supported and non-pile supported areas.
 - c. ASTM D2665 PVC pipe:
 - 1) PVC pipes shall not be used to handle liquids exceeding 110°F.
 - 2) PVC pipes shall be buried in accordance with all local code requirements and with the ASTM Standard relevant to the type of plastic piping system being installed. ASTM F 2536 - Standard Practice for Installing Plastic Piping Suspended from On-Grade Slabs. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 3) Provide stainless steel support hangers and rods at 2'-0' foot spacing with hangers at every joint and fitting. Furnish and install 1'-0" long, stainless steel, pipe saddles with every hanger for additional support. Provide two sheets of 1" thick insulated foam board fastened to the threaded rods by wire ties. Provide flexible connections / swing joints at all exterior underground connections between pile supported and non-pile supported areas.

Hanger Rod Sizing for Underground Pipe

Pipe Diameter	Min. Rod Size
2" and smaller	3/8"
3" and 4"	1/2"
6"	5/16"
8" and larger	3/4"

3. Pipe hangers and supports shall be furnished and installed in accordance with currently adopted local Plumbing Code and Standards.

3.04 INSTALLATION OF PIPING SPECIALTIES

- A. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover and of adequate size to remove valve cover for service.
 1. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:
 - a. As required by the currently adopted Plumbing Code.
 - b. At each change in direction of piping greater than 45 degrees.
 - c. At minimum intervals of 50 ft. for piping 4" and smaller and 75 ft. for larger piping.
 - d. At base of each vertical soil or waste stack.
 2. Cleanouts Covers: Install floor and wall cleanout covers for concealed piping, types as indicated.
- B. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

3.05 INSTALLATION OF FLOOR DRAINS

- A. General: Install floor drains in accordance with manufacturer's written instructions and in locations indicated.
- B. Coordinate flashing work with work of waterproofing and adjoining substrate work.
- C. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.
- D. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring.
- E. Maintain integrity of waterproof membranes, where penetrated.
- F. Position drains so that they are accessible and easy to maintain.
- G. Waterproof each floor drain above ground by providing a 16-inch x 16-inch flashing constructed in place using 40 mil chlorinated polyethylene sheets (Chloraloy 240). Install using manufacturers recommended procedure and in accordance with the Plumbing Code. Installation of flashing shall be coordinated with the floor construction.

3.06 CONNECTIONS

- A. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.
- B. Locate piping runouts as close as possible to the bottom of the floor slab supporting fixtures or drains.

3.07 FIELD QUALITY CONTROL

- A. Inspections:
 1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction and the engineer.
 2. During the progress of the installation, notify the plumbing official having jurisdiction and the engineer at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
 - a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
 - b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to confirm compliance with the requirements of the currently adopted Plumbing Code.
 3. Re-inspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspection by the plumbing official.

4. Reports: Prepare inspection reports, signed by the plumbing official.
- B. Piping System Test drainage and vent system as follows:
 1. Test for leaks and defects all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
 2. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing that has been covered or concealed before it has been tested and approved.
 3. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open jointed drain tile, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop for a period on no less than 4 hours. Inspect all joints for leaks.
 4. Finished Plumbing Test Procedure: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drains where it leaves the building and introduce air into the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.
 5. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
 6. Prepare reports for all tests and required corrective action.

3.08 ADJUSTING AND CLEANING

- A. Clean interior of piping system. Remove dirt and debris as work progresses.
- B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.09 PROTECTION

- A. Protect drains during the remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.
- C. Exposed ABS or PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of a water-based latex paint.

END OF SECTION

**SECTION 22 3300
ELECTRIC WATER HEATERS**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following electric water heaters:
 - 1. Flow-control, instantaneous electric water heaters.
 - 2. Commercial, storage electric water heaters.
 - 3. Compression tanks.
 - 4. Water heater accessories.

1.03 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Product Certificates: For each type of commercial and instantaneous electric water heater, signed by product manufacturer.
- D. Source quality-control test reports.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For electric water heaters to include in emergency, operation, and maintenance manuals.
- G. Warranty: Special warranty specified in this Section.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of electric water heaters and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- 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. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.

1.05 COORDINATION

- A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.06 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.

- c. Deterioration of metals, metal finishes, and other materials beyond normal use.
- 2. Warranty Period(s): From date of Substantial Completion:
 - a. Instantaneous Electric Water Heaters: One year.
 - b. Commercial Electric Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: Three years.
 - c. Compression Tanks: One year.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. 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.

2.02 INSTANTANEOUS ELECTRIC WATER HEATERS

- A. Flow-Control, Instantaneous Electric Water Heaters: Comply with UL 499 for tankless electric (water heater) heating appliance.
 - 1. Manufacturers:
 - a. Eemax, Inc.
 - b. Stiebel Eltron, Inc.
 - c. Bosch Thermotechnology
 - d. Or prior approved equivalent.
 - 2. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
 - a. Connections: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Heating Element: Resistance heating system.
 - d. Temperature Control: Flow-control fitting.
 - e. Safety Control: High-temperature-limit cutoff device or system.
 - f. Jacket: Aluminum or steel with enameled finish or plastic.
 - 3. Support: Bracket for wall mounting.
 - 4. Capacity and Characteristics:
 - a. Temperature Control: Flow-control fitting.
 - 1) Flow-Control Fitting: Refer to drawing schedules.
 - 2) Water Temperature Rise: Refer to drawing schedules.
 - b. Electrical Characteristics:
 - 1) Refer to drawing schedules.

2.03 COMMERCIAL ELECTRIC WATER HEATERS

- A. Commercial, Storage Electric Water Heaters: Comply with UL 1453 requirements for storage-tank-type water heaters.
 - 1. Manufacturers:
 - a. Bradford White Corporation.
 - b. Electric Heater Company (The); Hubbell Heaters Division.

- c. Lochinvar Corporation.
 - d. PVI Industries, LLC.
 - e. Rheem Water Heater Div.; Rheem Manufacturing Company.
 - f. Ruud Water Heater Div.; Rheem Manufacturing Company.
 - g. Smith, A. O. Water Products Company.
 - h. Or prior approved equivalent.
2. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement.
- a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
3. Factory-Installed Storage-Tank Appurtenances:
- a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - c. Insulation: Comply with ASHRAE/IESNA 90.1.
 - d. Jacket: Steel with enameled finish.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
4. Special Requirements: NSF 5 construction.
5. Energy Management System Interface: Normally closed dry contacts for enabling and disabling water heater.
6. Capacity and Characteristics:
- a. Refer to equipment schedule on drawings.

2.04 COMPRESSION TANKS

- A. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
1. Manufacturers:
- a. AMTROL Inc.
 - b. Armstrong Pumps, Inc.
 - c. Taco, Inc.
 - d. Watts Regulator Co.
 - e. Wessels Co.

- f. Or prior approved equal.
- 2. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
- 3. Capacity and Characteristics:
 - a. Refer to equipment schedule on drawings.

2.05 WATER HEATER ACCESSORIES

- A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than water heater working-pressure rating.
- C. Water Heater Drain-Pan Units: Provide stainless steel drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1 pipe thread.
- D. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
- E. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- F. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

2.06 SOURCE QUALITY CONTROL

- A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
- C. Prepare test reports.

PART 3 - EXECUTION

3.01 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases. Coordinate location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Cast-in-Place Concrete.
 - 1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains.

- E. Install thermometer on outlet piping of water heaters. Refer to Division 23 Section "Meters and Gages" for thermometers.
- F. Install pressure gage(s) on inlet and outlet of commercial electric water- heater piping. Refer to Division 23 Section "Meters and Gages" for pressure gages.
- G. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- H. Fill water heaters with water.
- I. Charge compression tanks with air.

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial and instantaneous electric water heaters. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION

**SECTION 22 4000
PLUMBING FIXTURES**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Requirements of Section 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.
- B. The requirements of the following Sections apply to this Section:
 - 1. Section 22 0500 - Common Work for HVAC, Plumbing, and Fire Protection
 - 2. Section 23 0516 - Piping and Fittings
 - 3. Section 22 0529 - Pipe Hangers
- C. Separate grab bar and toilet accessories are not an integral part of the plumbing fixtures and are specified under Section 10.

1.02 DESCRIPTION OF WORK

- A. Extent of plumbing fixtures 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. Stainless Steel Fixtures
 - 5. Mob Basin
 - 6. Tub and Showers
- C. Refer to Section 26 for field installed electrical wiring required for plumbing fixtures.

1.03 QUALITY ASSURANCE

- A. Plumbing Fixture Standards: Comply with applicable portions of the local and State Plumbing Code herein referred to as the Plumbing Code.
- B. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems, and bath tub units including the following:
 - 1. ANSI A112.6.1 – Supports for Off-the-Floor Plumbing Fixtures for Public Use.
 - 2. ANSI A112.18.1 – Plumbing Fixture Fittings.
 - 3. ANSI A112.19.2 – Vitreous China Plumbing Fixtures.
 - 4. ANSI A112.19.3 – Stainless Steel Plumbing Fixtures
- C. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
- D. NAHB Label: Provide fiberglass bath tub units and shower stalls which have been tested and labeled by NAHB Research Foundation, Inc.
- E. UL Compliance: Construct water coolers in accordance with UL Standard 399 "Drinking-Water Coolers," and provide UL-listing and label.
- F. 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."
- G. 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.
- H. 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."

- I. ASSE Compliance: ASSE 1037 – (Pressurized Flushing Devices)
- J. ADA Compliance: Construct and install barrier-free plumbing fixtures in accordance with Title III of the ADA of 1990 accessibility guidelines for buildings and facilities.

1.04 SUBMITTALS

- A. Product Data: Submit Manufacturer's Technical Product Data and installation instructions for each fixture, faucet, specialty, accessory, and trim specified; clearly indicate rated capacities of selected models of water coolers.
- B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages.
- C. Shop drawings shall be made in Autocad version 14 or higher and at a minimum scale of 1/4" per foot.
- D. Maintenance Data: Submit maintenance data and parts lists for each type of plumbing fixture and accessory; including "trouble-shooting" maintenance guide. Include this data and produce data in maintenance manual; in accordance with requirements of Section 01.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver plumbing fixtures, specialties, accessories, and trim individually wrapped in factory-fabricated containers.
- B. Handle plumbing fixtures specialties, accessories, and trim carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures specialties, accessories, or trim; replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL

- A. General: Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide trim and fittings including faucets, supplies, stops, traps, tailpieces, waste nipples, hangers, plates, brackets, anchors, supports, hardware, and fastening devices required for a complete installation.
- B. All vitreous china plumbing fixtures shall be furnished by the same manufacturer for each product specified throughout.
- C. All fixture trim shall be by same manufacturer for each product specified throughout.

2.02 MATERIALS

- A. 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.
- B. Where fixture trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.
- C. Stainless Steel: ASTM A 167, Type 302/304, hardest workable temper, with No. 4 finish having, bright, directional polish on exposed surfaces.
- D. 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.
- E. Fiberglass: ANS1 Z124, smooth surfaced, with color selected by Architect/Engineer.
- F. Synthetic Stone: High quality, free from defects, glaze on exposed surfaces, stain resistant.

2.03 PLUMBING FIXTURES

- A. Refer to plumbing drawing schedules.

2.04 SHOCK ABSORBERS

- A. Equivalent to Precision Plumbing Products as recommended by manufacturer.

2.05 TRAP PRIMER

- A. Equivalent to Precision Plumbing Products as recommended by manufacturer.

2.06 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide plumbing fixtures of one of the following:

2.07 WATER CLOSETS, URINALS, AND LAVATORIES

- A. Kohler Co.
- B. American Standard
- C. Crane Co.
- D. Toto
- E. Zurn Industries, Inc.

2.08 STAINLESS STEEL SINKS

- A. Zurn Industries, Inc.
- B. Elkay
- C. Acorn-Sinks, Acorn Engineering Co.
- D. Franke

2.09 STOPS AND SUPPLY TUBING

- A. Brass Craft
- B. Chicago Faucet Co.
- C. Kohler Co.
- D. McGuire
- E. T and S Brass and Bronze Works. Inc.
- F. Zurn Industries, Inc.

2.10 LAVATORY/SINK FAUCETS AND TRIM

- A. Chicago Faucet Co.
- B. Delta Faucet Co; Div. of Masco Corp.
- C. American Standard
- D. Kohler Co.
- E. Franke
- F. Zurn Industries, Inc.

2.11 LAVATORY/SINK P-TRAPS AND TAILPIECES

- A. Crane
- B. Eljer
- C. Kohler Co.
- D. McGuire
- E. Zurn Aqua-Spec
- F. ADA INSULATION KITS
- G. True Bro
- H. SKAL – GARD
- I. Plumberex

2.12 FIXTURE CARRIERS

- A. Josam Mg. Co.
- B. J.R.Smith Mfg. Co.

- C. Wade Div.
- D. Zurn Industries, Inc.

2.13 FIXTURE SEATS

- A. Bemis Mfg. Co.
- B. Beneke Corp.
- C. Church Products, Forbes-Wright Industries. Inc.
- D. Olsonite Corp.
- E. Zurn Industries, Inc.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Installer of rough-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. 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.

3.02 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, rough-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of The Americans with Disabilities Act of 1990 (including all applicable amendments), ANSI A117.1 and the 2000 Louisiana State 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.
- D. Caulk around all wall or floor mounted fixtures using nonporous-bond silicone rubber mold/mildew resistant acid type sealant depositing a uniform continuous ribbon without gaps or air pockets, and with complete "wetting" of joint bond surfaces equally on opposite sides. Fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal and vertical surface, fill joints to form a slight cove, so that joint will not trap moisture and dirt.
- E. Flush Controls designated as "barrier free" which are hand operated or automatic shall comply with The Americans with Disabilities Act of 1990, Article 4.16.5 and 4.27.4. Controls for flush valves shall be mounted on the wide side of toilet areas no more than 44 inches above the floor to centerline of trip lever/push button for use by adults, and no more than 32" above the floor to centerline of trip lever/push-button for use by children in elementary schools.
- F. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

3.03 MOUNTING HEIGHTS SCHEDULE

<u>FIXTURE</u>	<u>MOUNTING HEIGHT</u>
Water Closet	15" floor to seat
Wheelchair Water Closet	17" floor to seat
Standard Urinals	24" floor to rim
Barrier free Urinals	17" floor to rim
Lavatory or Sink	31" floor to rim
Barrier free Lavatories	29" Min. Knee Clearance

3.04 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 Architect/Engineer. Remove cracked or dented units and replace with new units.

3.05 ADJUSTING AND CLEANING

- A. Clean plumbing fixtures, trim and strainers of dirt and debris upon completion of installation.
- B. Adjust water pressure at drinking fountains, 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.

END OF SECTION

SECTION 23 0513 MOTORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes basic requirements for factory and field-installed motors.

1.03 DEFINITIONS

- A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
- B. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.

1.04 SUBMITTALS

- A. Product Data for Field-Installed Motors: For each type and size of motor, provide nameplate data and ratings; shipping, installed, and operating weights; enclosure type and mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.
- B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:
 - 1. Each installed unit's type and details.
 - 2. Nameplate legends.
 - 3. Diagrams of power, signal, and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.
- C. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around field-installed motors. Show motor layout, mechanical power transfer link, driven load, and relationship between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- D. Operation and Maintenance Data: For field-installed motors to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

- A. All motors furnished shall be designed, manufactured, and tested in accordance with the latest applicable standards of NEMA, ANSI, IEEE, and ASTM. As a minimum requirement, all motors shall conform to the latest applicable sections of NEMA Standard No. MG-1. Motors must meet or exceed CEE Premium Efficiency™ full load efficiencies. The Consortium for Energy Efficiency (CEE), a national, non-profit public benefits corporation, promotes the manufacture and purchase of energy-efficient products and services.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- C. Source Limitations: Obtain field-installed motors through one source from a single manufacturer.

- D. Product Options for Field-Installed Motors: Drawings indicate size, profiles, and dimensional requirements of motors and are based on the specific system indicated. Refer to Division 01.
- E. 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.
- F. Comply with NFPA 70.
- G. Comply with the requirements of the currently adopted ASHRAE/IESNA 90.1 Standard.

1.06 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:
 - 1. Compatible with the following:
 - a. Magnetic controllers.
 - b. Multispeed controllers.
 - c. Reduced-voltage controllers.
 - 2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
 - 3. Matched to torque and horsepower requirements of the load.
 - 4. Matched to ratings and characteristics of supply circuit and required control sequence.
- B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.
- C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.01 MOTOR REQUIREMENTS

- A. Motor requirements apply to factory and field-installed motors except as follows:
 - 1. Different ratings, performance, or characteristics for motors that are specified in another Section.
 - 2. Motorized-equipment manufacturer required ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.
- B. APPROVED MOTOR MANUFACTURERS
 - 1. U.S. Motors
 - 2. Baldor
 - 3. Marathon Electric
 - 4. WEG
 - 5. Or prior approved equivalent

2.02 MOTOR CHARACTERISTICS:

- A. Motors Smaller Than 1/2 HP: Single phase.
- B. 1/2 HP Motors: Single phase or Three Phase.
- C. Motors 3/4 HP and Larger: Three phase.
- D. Frequency Rating: 60 Hz.
- E. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- F. Service Factor: 1.15

- G. Power Factor: All motors 1 HP and larger shall have a composite power factor rating of 90% to 100% when the driven equipment is operating at the design duty.
- H. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at an altitude up to 3300 feet above sea level.
- I. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- J. Unless otherwise indicated, motor enclosure shall be as follows:
 - 1. Open Drip-proof (ODP) for indoor applications.
 - 2. Totally Enclosed Fan Cooled (TEFC) for outdoor applications.
 - 3. Explosion-proof for hazardous applications.

2.03 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, squirrel cage, induction motor.
- B. Efficiency: Premium, as defined in NEMA MG 1, Part 31.
- C. Stator: Copper windings, unless otherwise indicated.
 - 1. Multispeed motors shall have separate winding for each speed.
- D. Rotor: Squirrel cage, unless otherwise indicated.
- E. Bearings: Double-shielded, pre-lubricated ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating, unless otherwise indicated.
- G. Insulation: Class F, unless otherwise indicated.
- H. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure: Cast iron for motors 5 HP and larger; rolled steel for motors smaller than 5 HP.
 - 1. Finish: Manufacturer's standard finish.

2.04 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors used with Adjustable Frequency Drives (AFD): Ratings, characteristics, and features coordinated with and approved by AFD manufacturer.
 - 1. Designed with critical vibration frequencies outside operating range of controller output.
 - 2. Temperature Rise: Class B temperature rise at 1.0 Service Factor by resistance with sine wave power.
 - 3. Thermal Protection: Meet or exceed NEMA MG 1, Part 31 requirements for thermally protected motors.
- C. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with non-hygroscopic material.
 - 1. Finish: Chemical-resistant paint over corrosion-resistant primer.
- D. Source Quality Control for Field-Installed Motors: Perform the following tests on each motor according to NEMA MG 1 requirements:
 - 1. Measure winding resistance.
 - 2. Read no-load current and speed at rated voltage and frequency.
 - 3. Measure locked rotor current at rated frequency.

4. Perform high-potential test.

2.05 SINGLE-PHASE MOTORS

- A. Motors shall have a minimum efficiency of 70% when rated in accordance with Department of Energy 10 CFR Part 431. Direct drive motors shall have the means to adjust motor speed for either balancing or remote control.
- B. Electrically Commutated Motor (ECM): For motors 1/12 hp or greater and less than 1 hp.
- C. Shaded-Pole Motors: For motors 1/20 hp and smaller only.
- D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.
- E. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, pre-lubricated sleeve type for other single-phase motors.
- F. Source Quality Control for Field-Installed Motors: Perform the following tests on each motor according to NEMA MG 1 requirements:
 1. Measure winding resistance.
 2. Read no-load current and speed at rated voltage and frequency.
 3. Measure locked rotor current at rated frequency.
 4. Perform high-potential test.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive field-installed motors for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Examine roughing-in for conduit systems to verify actual locations of conduit connections before motor installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FIELD-INSTALLED MOTOR INSTALLATION

- A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.
- B. Comply with mounting and anchoring requirements specified in Division 23 Section "Vibration Isolation."

3.03 FIELD QUALITY CONTROL FOR FIELD-INSTALLED MOTORS

- A. Prepare for acceptance tests.
 1. Align motors, bases, shafts, pulleys, and belts. Tension belts according to manufacturer's written instructions.
 2. Verify bearing lubrication.
 3. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
 4. Test interlocks and control and safety features for proper operation.
 5. Verify that current and voltage for each phase comply with nameplate rating and NEMA MG 1 tolerances.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

- C. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
 - 1. Perform electrical tests and visual and mechanical inspections including optional tests and inspections stated in NETA ATS on factory and field- installed motors. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace them with new units and retest.

3.04 FIELD-INSTALLED MOTOR DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain field-installed motors.

END OF SECTION

**SECTION 23 0516
HVAC PIPING & FITTINGS**

PART 1 - GENERAL

1.01 PROVISIONS

- A. Requirements of Division 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration in accordance with Division 01. Those judged to be equal to that specified, will receive written approval.

1.02 DESCRIPTION

- A. Work covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawings.
- B. The work described in this section of the specifications includes but is not limited to the following:
 - 1. Provide and install piping of every kind for mechanical systems with all necessary hangers, fittings, and hardware as necessary for fully functional piping systems.
- C. All piping nipples for chilled water, heating hot water, and condenser water systems shall be red brass only. No exceptions.

1.03 RELATED WORK

- A. The following items of related work are specified and included in other sections of these specifications:
 - 1. Section 22 05 29: Pipe Hangers and Supports.
 - 2. Section 23 05 19: Thermometers and Gauges for Hydronic Piping.
 - 3. Section 23 05 23: Valves.
 - 4. Section 23 05 93: HVAC Testing, Adjusting and Balancing Requirements.
 - 5. Section 23 07 00: Mechanical System Insulation

1.04 SUBMITTALS

- A. Submit seven copies of all piping and fittings for review by the Architect.

PART 2 - PRODUCTS

2.01 STEEL PIPE

- A. Manufacturers who are fully experienced, reputable, and qualified in the manufacture of the products to be furnished shall furnish all steel pipe and fittings. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.
- B. Manufacturers for Steel Pipe and Fittings: Bethlehem, Le Barge Pipe Bending & Coiling, Ohio Pipe, Grinnell, U.S. Steel, Tube Turn, Victaulic, Fee & Mason, Gustin-Bacon, Allied, Daniel, Ladish, Naylor, Anvil, Cajon, or prior approved equal.
- C. Carbon steel pipe, ASTM A53 or A106, Grade B, Type S seamless or Type E electric resistance welded, Schedule 40. Mechanical grooved type pipes and fittings may be used as a substitute pipe joint method at Contractors option. Grooved type joints and fittings shall only be permitted where the joints are located to be readily accessible or provided with service access, and where a leak or seepage will not cause damage or loss. All pipe shall be manufactured in the continental United States of America.

NOTE: If contractor proposes to use pipe that is manufactured and/or sourced from other countries outside the continental United States, then it shall meet all currently adopted Codes and Standards (ASTM, ANSI, AWS, AWWA, etc.) currently enforced in the United States. A 10-year warranty from the Certificate of Acceptance shall be included from the Contractor, and shall cover the pipe replacement cost, freight cost to project site, and cost of damages to property should the pipe fail due to defects in material or workmanship. Submit all pipe sourcing certificates for review and record. Piping sourced from China is not acceptable.

1. 2-1/2" through 10": Chilled Water Supply and Return, Condenser Water Supply and Return, Heating Hot Water, Make-up Water, Cooling Tower Drain and Overflow.
2. 2" and smaller: Cooling Tower Drain and Overflow.

2.02 STEEL PIPE FITTINGS

- A. Flanges, Fittings, Unions and Similar Items: Commercially available products marked in accordance with MSS-SP-25 marking on small size of odd shaped products may be omitted provided they are listed in the sequence so allowed by MSS-SP-25, but such products shall bear the manufacturer's name and trademark. Provide weld neck flanges for all flanged valve connections. Slip-on flanges are not acceptable unless allowed by valve manufacturer and installed per manufacturer's recommendations.
- B. Fittings 2-1/2" through 10": Steel butt weld fittings, ANSI B16.9, ASTM A234, Grade WPB, long turn ells. Weld-o-lets and thread-o-lets permitted if branch is at least 2 pipe sizes smaller than main, fittings at least wall thickness to match pipe.
- C. Fittings 2" and smaller: Malleable iron threaded fittings, ANSI B16.3. Fittings shall be 125 lb. minimum for pressures less than 75 PSI and 300 lb. for pressures above 75 PSI. Steam condensate shall be 300 lb. for all pressures.
- D. Flanges: Carbon steel, ANSI B16.5 weld neck. Class 300 flanges required for steam service.
- E. Mechanical Fasteners: Steel bolts and hex nuts, ASTM F1941, for all flanged and/or grooved type pipe, fittings and valves.
- F. Pipe joints for 2-1/2" through 10": Butt weld to ANSI B31.1 and MCAA Part VII, Standard Procedure Specification Parts 1 & 2.
 1. Grooved joints in domestic/lab/non-potable and chilled water pressurized systems shall only be permitted where the joints are located to be readily accessible or provided with service access, and where a minor leak or seepage would not cause significant damage or loss.
 2. Grooved joint: ASTM A536 Ductile Iron coupling, ASTM F941 mechanical fasteners with minimum tensile strength of 10,000 psi, ASTM D2000 rubber gaskets rated for service application. Roll groove method only. Cut groove shall be utilized for applications where piping has interior lining or coating, including galvanized systems.
- G. Pipe joints for 2" and smaller: Threaded using American Standard for Pipe Threads, ANSI B2.1 with thread sealant or Teflon tape material especially listed compatible with system contents, pipe materials, and operating conditions.
- H. Thread lubricant: (Note: Approved Teflon tape may be used except on natural gas piping.)
- I. Gaskets: 1/8" thick Cranite, Sepco, or prior approved equal.
- J. Nipples: Unless otherwise noted, provide red-brass nipples to all pipe instruments including, but not limited to, instrument and temperature gauge thermo-wells, pressure gauges, etc. Nipples shall be designed and manufactured in accordance with Federal Specification WNN-351a, ASTM B687-88 and MS 51846.

2.03 COPPER PIPE

- A. Manufacturers for Copper Piping and Fittings: Anderson Metals Corp., Brasscraft, Mueller Brass, Elkhart, Milwaukee, Nibco, Anaconda, or prior approved equal.
- B. Chilled Water Supply and Return, Make-up Water, Heating Hot Water and Condensate Drain.
 1. 2" and smaller: Type L, hard drawn, seamless, conforming to ASTM B88

- C. Refrigerant
 - 1. 2" and smaller: Seamless copper tube, ASTM B88, ASTM B280 type ACR, Type L.

2.04 COPPER PIPE FITTINGS

- A. Sweat type, wrought copper, ASTM B75, with dimensions conforming to ANSI B16.22 and sweep patterns for copper tubing.
- B. Press fittings: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or B16.22. O-rings for the copper press fittings shall be EPDM. Press fittings shall be as manufactured by Viega, LLC or prior approved equivalent.
- C. Dielectric couplings: Merit Brass Company or "V-line" (as manufactured by Lochinvar Company) dielectric couplers. Use couplers at junction of steel pipe and equipment with copper piping systems. Do not use steel or cast iron fittings in copper piping system. Brass fittings shall be used for dielectric locations. Provide brass dielectric flange kits at dissimilar metal flange connections.
- D. Unions: Brass ground joint, 250 lb. working pressure minimum, unless otherwise noted.
- E. Nipples: Unless otherwise noted, provide red-brass nipples to all pipe instruments including, but not limited to, instrument and temperature gauge thermo-wells, pressure gauges, etc. Nipples shall be designed and manufactured in accordance with Federal Specification WNN-351a, ASTM B687-88 and MS 51846.

2.05 MISCELLANEOUS PIPE ACCESSORIES

- A. Sleeves: Schedule 10 or 40 steel pipe or 16 gauge galvanized sheet metal, except use 18 gauge galvanized sheet metal for floor penetrations in mechanical rooms.
- B. Escutcheons: Chrome pipe escutcheons, slip-on or split type where pipe passing through finished walls may be visible. Escutcheons are not required in mechanical rooms and janitor closets.
- C. Exposed Metal Pipe and Trim in administrative and public areas: Chrome plated.
- D. Pipe saddles to be 16 gauge galvanized installed to protect insulation as required by appropriate section of this chapter.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

- A. Clean inside of pipe before installing. Keep installed piping clean and protect ends from foreign matter by capping or plugging them. Piping shall be stored raised from the floor or ground.
- B. Prevent entry of foreign matter during construction, clean pipe, fittings, and valves internally and hammer welds to remove all loose dirt, mill scale, metal chips, weld beads rust and harmful substances. Flush piping system with clear water prior to connection to coils, control valves and equipment.
- C. Pipes shall be cleaned free of scale and thoroughly flushed of all foreign matter. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from all water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to settings indicated.
- D. Install pipe so that it does not interfere with: Opening of doors or apparatus; Access to equipment; Any portion of electrical equipment.
- E. Run pipes in straight lines and square with building. Install rise plumb. Make offsets only where indicated and where necessary.
- F. Install pipe tee fittings in a manner that avoids bullhead flow conditions. Flow (supply or return) shall only be allowed to enter a tee fitting at 90 degree angles.

- G. Install pipes so that expansion and contraction will not cause undue stress or strain to pipes or equipment. Provide loops, offsets, and expansion joints as shown on drawings. If, in Contractor's opinion, inadequate loops or offsets are shown, contact POR for clarification.
- H. Provide flanges and unions throughout the pipe systems to make installation and removal of piping and equipment convenient. Make provisions for servicing and removal of equipment without dismantling piping.
- I. Fire Barrier Penetrations: Where pipes pass through time rated fire restive construction including fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division-7 for special sealers and materials.

3.02 PIPE JOINTING

- A. Preparing Pipe Ends:
 - 1. Cut pipe ends square with pipe cutters only. Do not use hacksaws or torch.
 - 2. Ream pipe ends, after cutting, to full diameter.
 - 3. Where pipe is to be threaded, die-cut right hand, pipe stand, clean cut full depth, taper threads. Make threaded joints so that they will be leakproof without caulking.
 - 4. Apply a thin coat of approved pipe lubricant to make threads only.
- B. Soldered and Brazed Joints:
 - 1. Soft copper pipe joints for hydronic water systems shall be made with suitable flux and 95/5 solder.
 - 2. All refrigerant pipe joints shall be brazed only.

3.03 ESCUTCHEONS

- A. Provide chrome plated escutcheons where non-insulated pipes penetrate walls of finished spaces.

3.04 VALVE ACCESS

- A. Locate shut off and control valves for easy access and operation. Refer to Division 08 for access door requirements.

3.05 CONTROL SYSTEMS CONNECTORS

- A. Weld connectors at points indicated, and at other points where necessary for installation of thermometers and automatic controls.

3.06 LEAK TESTING

- A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary. Leak tests may be either of those below, or a combination.
 - 1. An operating test at design pressure, and for hot systems, at design maximum temperature.
 - 2. A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head or expansion tank maximum pressure plus pump head pressure. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Isolate equipment where necessary to avoid excessive pressure on mechanical seals and safety devices.

3.07 FLUSHING AND CLEANING PIPING SYSTEMS

- A. After erection, flush with clean water and seal ends after cleaning.
- B. Open all valves, drains, vents and strainers at all system levels.
- C. Remove plugs, caps, spool pieces and components to facilitate early debris discharge from system.
- D. Isolate or protect clean systems components including, but not limited to, pressure vessels and any system components that may be damaged during the flushing process. Install temporary strainers where necessary.

- E. Flush bottoms of risers.
- F. After initial flushing, fill with clean water, add pipe cleaning product recommended for removal of adherent organic soils, hydrocarbon flux, pipe mill varnish, joint compounds, rust and harmful substances not removed by initial flushing. Circulate water through system for at least 4 hours. At end of the 4 hour period, remove and clean temporary strainers and blow off at low points, then completely drain out systems of cleaning solution.
- G. Refill systems with clean water and circulate for an additional 2 hour period, operate all valves to dislodge any remaining debris and, at the end of that interval, completely drain system.
- H. Refill with clean water, circulate, and provide water treatment as required. Coordinate with the water treatment contractor, as required, to confirm that systems and equipment have been properly cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system. Refer to "HVAC Water Treatment" specifications for additional requirements.

3.08 RECHECKING AND REPAIRING

- A. Before piping is concealed, recheck for leaks.
- B. Rework or replace defective and leaking joints, and joints which are otherwise unsatisfactory. Peening, caulking, and doping are not permitted.

END OF SECTION

SECTION 23 0519
THERMOMETERS AND GAUGES FOR HYDRONIC PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Requirements of Division 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Thermometers
 - 2. Pressure Gauges
 - 3. Test plugs
- B. Related Sections:
 - 1. Section 22 1116 - Domestic Water Piping
 - 2. Section 23 0516 - Piping and Fittings
 - 3. Section 23 0900 - Instrumentation and Controls for HVAC
 - 4. Section 23 2113 - Hydronic Specialties

1.03 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Certificates: For each type of product.
- C. Operation and Maintenance Data.

PART 2 - PRODUCTS

2.01 LIGHT-POWERED DIGITAL TYPE THERMOMETERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. H.O.Terice Co.
 - 2. Weiss Instruments, Inc.
 - 3. Weksler Glass Thermometer Corp.
- B. Indoor Applications: Direct-Mounting, Light-Powered Thermometer: Digital type conforming with ASME B40.3 and/or Fed Spec GG-T-321D. Fully interchangeable with Industrial Glass and Bimetallic Dial Thermometers.
 - 1. Case: High-Impact ABS (Acceptable for Indoor Applications Only), Cast Aluminum or Stainless Steel (Approved for Outdoor Use Applications)
 - 2. Stem: Adjustable-angle, industrial glass or bi-metallic for thermowell installation and of length to suit installation.
 - 3. Connection: 304 Stainless Steel, 1/4" diameter.
 - 4. Sensor: Glass passivated thermistor
 - 5. Range: -40 deg F to 300 deg F
 - 6. Display: 1/2" (min.) LCD digits
 - 7. Accuracy: 1% of reading or 1°; whichever is greater.

8. Resolution: 1/10° between -19.9/199.9°F
 9. Update Interval: 10 seconds
 10. Lux Rating: 10 Lux (one foot-candle)
 11. Ambient Operating Temperature: -30 deg F to 140 deg F
 12. Ambient Temperature Error: None.
 13. Humidity Rating: 100% RH, non-condensing
- C. Outdoor Applications: Direct-Mounting, Light-Powered Digital Thermometer Suitable for Outdoor Use.
1. Case: Cast Aluminum, Blue epoxy finish NEMA-4X / IP 65.
 2. Stem: Adjustable-angle, industrial or bi-metallic for thermowell installation and of length to suit installation.
 3. Connection: Industrial (1 1/4 -18 UNEF-2A coupling nut) or bi-metal (304 Stainless steel stem 1/4" diameter, 1/2 NPT).
 4. Sensor: Glass passivated thermistor
 5. Range: -40 deg F to 300 deg F
 6. Display: 9/16" (min.) LCD digits
 7. Accuracy: 1% of reading or 1°; whichever is greater.
 8. Resolution: 1/10°
 9. Update Interval: 10 seconds
 10. Lux Rating: 10 Lux (one foot-candle)
 11. Ambient Operating Temperature: -40 deg F to 140 deg F
 12. Ambient Temperature Error: None.

2.02 THERMOWELLS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. H. O.Terice, Co.
 2. Weiss Instruments, Inc.
 3. Weksler Glass Thermometer Corp.
- B. Manufacturers: Same as manufacturer of thermometer being used.
- C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.03 PRESSURE GAUGES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Weiss Instruments, Inc.
 2. Tel-Tru Manufacturing Corporation.
 3. Weksler Glass Thermometer Corp.
- B. Direct-Mounting, Dial-Type Pressure Gauges: Indicating-dial type complying with ASME B40.100.
1. Case: 4-1/2 inch diameter, Liquid-filled type, 304 stainless steel case with polished stainless steel ring.
 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.

3. Pressure Connection: Stainless Steel, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 5. Dial: White aluminum, with permanently etched black and red scale markings (psi & kPa).
 6. Pointer: Black or other dark-color metal.
 7. Window: Glass.
 8. Ring: Stainless steel.
 9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 30 psig of pressure.
 11. Range for Fluids under Pressure: Two times the operating pressure.
- C. Direct-Mounting, Light-Powered Pressure Gauges: Digital type conforming with ASME B40.7.
1. Case: 4-1/2 inch diameter, Black Glass Reinforced Thermo Plastic (PBTP) solid front construction, blow out back safety design, weatherproof IP65.
 2. Window: Acrylic.
 3. Sensor: Lux Capacitor
 4. Wetted Materials: 316 Stainless Steel.
 5. Connection: 1/4 inch or 1/2 inch NPT lower or lower back connected.
 6. Range: Vacuum to 1,000 psi.
 7. Display: LCD.
 8. Accuracy: 0.5% Full Scale (ASME B40.7 AA).
 9. Ambient Operating: -15 deg F to 150 deg F.
 10. Lux Rating: 10 Lux (one foot-candle).
 11. Resolution: 1/4% first half, 1/2% second half
 12. Digits: 5/8" High
 13. Update Interval: 1 to 8 seconds (adjustable)
- D. Pressure-Gauge Fittings:
1. Valves: NPS 1/4 brass or stainless-steel needle type.
 2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
 3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.04 TEST PLUGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Flow Design, Inc.
 2. MG Piping Products Co.
 3. National Meter, Inc.
 4. Peterson Equipment Co., Inc.
 5. Sisco Manufacturing Co.
 6. Trerice, H. O. Co.
 7. Watts Industries, Inc.; Water Products Div.

- B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.
- C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- D. Core Inserts: One or two self-sealing rubber valves.
 - 1. Insert material for oil or gas service at 20 to 200 deg F shall be CR.
 - 2. Insert material for air or water service at minus 30 to plus 275 deg F shall be EPDM.
- E. Test Kit: Furnish one test kit containing one pressure gauge and adaptor, one thermometer, and carrying case. Pressure gauge, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.
 - 1. Pressure Gauge: Small bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be 0 to 200 psig.
 - 2. Low-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be [25 to 125 deg F.]
 - 3. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.
 - 4. Carrying case shall have formed instrument padding.

PART 3 - EXECUTION

3.01 THERMOMETER APPLICATIONS

- A. Install thermometers in approximate locations as shown on drawings, details and schematics.

3.02 PRESSURE GAUGE APPLICATIONS

- A. Install pressure gauges in approximate locations as shown on drawings, details and schematics.

3.03 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install remote-mounting dial thermometers on panel, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.
- C. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.
- D. Duct Thermometer Support Flanges: Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.
- E. Install direct-mounting pressure gauges in piping tees with pressure gauge located on pipe at most readable position.
- F. Install remote-mounting pressure gauges on panel.
- G. Install needle-valve and snubber fitting in piping for each pressure gauge for fluids (except steam).
- H. Install needle-valve and syphon fitting in piping for each pressure gauge for steam.
- I. Install test plugs in tees in piping.
- J. Install flow indicators, in accessible positions for easy viewing, in piping systems.
- K. Assemble and install connections, tubing, and accessories between flow-measuring elements and flow meters as prescribed by manufacturer's written instructions.
- L. Install flow meters as prescribed by manufacturer's written instructions.

3.04 CONNECTIONS

- A. Install meters and gauges adjacent to machines and equipment to allow service and maintenance for meters, gauges, machines, and equipment.

3.05 ADJUSTING

- A. Calibrate meters and gauges according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gauges to proper angle for best visibility.

END OF SECTION

**SECTION 23 0548
VIBRATION ISOLATION**

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. This section provides minimum acceptance requirements for vibration isolation for all mechanical equipment, ductwork and piping.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Section, apply to this Section.
- B. Ductwork flexible connections are specified elsewhere in Division 23.
- C. Vibration isolation for electrical systems is provided in Division 26.

1.03 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers.
- D. OSHA: Occupational Safety and Health Administration.

1.04 QUALITY ASSURANCE

- A. Unless otherwise directed by the local authority having jurisdiction, currently adopted codes and standards will apply as follows:
 - 1. International Building Code
 - 2. American Society of Civil Engineers
 - 3. Manufacturer's Standardization Society MSS-58
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.05 SUBMITTALS

- A. Submit shop drawings for all devices specified herein and as indicated on the drawings. Submittals shall include dimensions, materials, attachment and anchorage requirements. Indicate compliance with each specification item herein.
- B. Delegated-Design Submittal: For vibration isolation details 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. Design Calculations: Calculate static and/or dynamic loading due to equipment weight and operation to select vibration isolators and for designing vibration isolation bases.
 - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure and spring deflection changes. Include certification that riser system has been examined for excessive stress and that none will exist.
 - 3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
- C. Welding certificates.
- D. Qualification Data: For professional engineer and testing agency.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Certain items in this Specification are listed by manufacturer and/or manufacturer's model number to establish general style, type, character and quality of the product desired. Similar items manufactured by other than those listed will be considered, providing submittals are made according to Pre-Bid Approval requirements of Instructions to Bidders.
- B. Where no manufacturer or model number are given, any product meeting performance or design criteria, or referenced trade association standard may be used and Pre-Bid Approval is not required.
- C. Manufacturers: Subject to compliance with requirements for complete systems provide products of one of the following and all vibration isolation systems shall be by one manufacturer. Approved vibration isolation manufacturers are as follows:
 - 1. Vibro-Acoustics.
 - 2. Mason Industries.
 - 3. Amber-Booth
 - 4. Kinetics
 - 5. Or prior approved equivalent.

2.02 VIBRATION ISOLATORS AND MOUNTINGS

- A. General
 - 1. Unless otherwise specified in this Division all machinery or vibrating mechanical equipment shall be isolated from the building structure by vibration isolators with a minimum deflection as specified. Operating equipment that can transmit objectionable vibration and noise must be installed with special types of vibration isolators such as flexible connectors to ductwork, piping and wiring. In more critical areas and under particular conditions, additional vibration isolators shall be installed as specified in other related Sections in this Division, or in specific equipment schedules.
 - 2. All equipment shall be provided with attachment points for floor or suspended mounting that will safely transmit all loads to the supports.
 - 3. The vibration isolator manufacturer shall be responsible for the proper selection of vibration isolators suitable for the particular application. Selection of the vibration isolator shall include the following factors:
 - a. Equipment Weight
 - b. Equipment operating frequencies
 - c. Type of building support structure
 - 4. Unless otherwise noted, vibration isolators shall be furnished by the vibration isolation manufacturer.
 - 5. All floor mounted vibration isolators shall be bolted to the floor or framing on which they rest. Bolts shall be arranged to prevent transmission of vibration through the bolts.
 - 6. All springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. All springs except internal nested springs shall have an outside diameter not less than 0.8 of the compressed height of the spring. Ends of springs shall be square and ground for stability. Laterally stable springs shall have k_x/k_y ratios of at least 0.9. All springs shall be fully color-coded to indicate capacity – color striping is not considered adequate.
 - 7. Bases shall be of welded construction with cross members to form an integral support platform. Structural steel members shall be designed to match supported equipment. Vibration bases for fans shall have adjustable motor slide rails, and shall accommodate motor overhang. Bases for exterior use shall be painted or hot-dipped galvanized for complete corrosion resistance.

8. All isolation devices for a single piece of equipment shall be selected for a uniform static deflection according to distribution of weight in the equipment.
9. All pieces of equipment that have a variation in weight during operation or maintenance such as, but not limited to, cooling towers, shall have built-in vertical limit restraints to limit motion to a maximum of 1/4-in.
10. Equipment with large variations in the operating and installed weight, such as chillers, boilers, etc., shall be mounted on spring mountings, including a neoprene acoustical pad within a rigid sided housing that includes vertical limit stops to prevent spring extension when weight is removed and temporary steel spacers between the upper and lower housings. Housings shall serve as blocking during erection. When the equipment is at full operating weight, the springs shall be adjusted to assume the weight and the spacers removed, without changing the installed and operating heights. All restraining bolts shall have large rubber grommets to provide cushioning in the vertical as well as horizontal modes. The hole through the bushing shall be a minimum of 0.75" larger in diameter than the restraining bolt. Horizontal clearance on the sides between the spring assembly and the housing shall be a minimum of 0.5" to avoid bumping and interfering with the spring action. Vertical limit stops shall be out of contact during normal operation.
11. Cork rubber type isolation pads are not acceptable.
12. Isolators exposed to the weather or in damp, wet, or corrosive environments shall be provided with corrosion protection. Steel parts other than springs shall be hot-dipped galvanized. Parts subject to wear, rubbing, shall be non-corrosive material such as rubber or stainless steel. Springs and hardware shall be cadmium plated or otherwise provided with an approved coating.
13. After installation of equipment, isolators shall be adjusted for proper loading and distribution of weight.
14. Select and locate vibration isolation equipment to give uniform loading and deflection, according to weight distribution of equipment.
15. Unless otherwise noted, minimum static deflection for spring-type isolators shall be 1 inch.
16. Unless otherwise noted, all internally isolated air handling units shall be provided with minimum 1" thick, oil resistant, solid neoprene pads. Pads shall be located between the air handling unit base rail and the emergency drain pan.
17. Air handling units with independently mounted fan sections shall be provided with tension adjustable thrust restraints to counteract reaction forces due to air flow. Restraints shall be arranged to allow a maximum 1/4-in of motion at start-up or shutdown.
18. Floor mounted fans shall be provided with structural steel vibration bases common to both fan and motor. Slab-on-grade installations shall be provided with spring-type isolators with a minimum 1" static deflection. Above-grade installations shall be provided with spring-type isolators with a minimum 2" static deflection. There shall be a minimum operating clearance of 1" between each steel base and the structure.
19. All floor-mounted pumps shall be mounted on concrete-filled inertia bases. Concrete in-fill shall be supplied by the installing contractor on site. Inertia bases shall be arranged with spring isolator locations such that a horizontal plane passing through the top of the isolators will pass through or above the center of gravity of the equipment and base. Slab-on-grade installations shall be provided with spring-type isolators with a minimum 1" static deflection. Above-grade installations shall be provided with spring-type isolators with a minimum 2" static deflection. There shall be a minimum operating clearance of 2" between each inertia base and its foundation.
20. Engine-generator sets shall be supported with spring-type isolators with a minimum 3" static deflection. There shall be a minimum operating clearance of 2" between each inertia base and its foundation.

21. Engine-generator set silencers and associated exhaust piping shall be supported with spring-type isolators with a minimum 1.5" static deflection.
22. Skid-mounted air compressors shall be supported with housed spring-type isolators. Slab-on-grade installations shall be provided with spring-type isolators with a minimum 1" static deflection. Above-grade installations shall be provided with spring-type isolators with a minimum 2" static deflection.
23. Extent of Piping Isolation:
 - a. Isolate all piping between 2" and 10" dia. and directly connected to motorized and/or vibration isolated equipment with 1" static deflection spring hangers.
 - b. Isolate all piping larger than 10" dia. and directly connected to motorized and/or vibration isolated equipment with 2" static deflection spring hangers.
 - c. Spring hangers shall be spaced at intervals in accordance with the following:

Pipe Diameter	Distance from Vibrating Equipment
2" to 4"	50'
6" and 8"	60'
10" and larger	70'
24. Chilled, Condenser, and Domestic Cold and Hot Water Piping:
 - a. Horizontal:
 - 1) Pipe stand supports shall be supported on isolators. The first 3 isolators shall have the same minimum static deflection as the equipment isolators. The remaining isolators shall have a minimum 1" static deflection.
 - 2) Piping shall be suspended with isolators. The first 3 hangers shall have the same minimum static deflection as the equipment isolators, with a maximum of 2". The remaining isolators shall have a minimum 1" static deflection.
 - b. Vertical:
 - 1) Piping shall be isolated from the supporting members or structure with isolators with a minimum 1" static deflection.
25. Extent of Ductwork Isolation:
 - a. Provide vibration isolation for ductwork as required.
 - b. Floor-supported ductwork shall be isolated from the structure with isolators with minimum 1" static deflection.
26. There shall be no direct contact of isolated piping, ductwork, or equipment with shaft walls, floor slabs, partitions, or conduits.
27. Provide height saving brackets where recommended by the manufacturer for equipment stability, or operating height requirements.
28. Where recommended by the manufacturer, isolator base plates shall be bolted to the structure or foundation. Bolting shall incorporate neoprene bushings and washers.
29. Provide spring-loaded thrust restraints for fans and air handling units where movement under any operating condition will exceed 0.375".
30. Isolation hangers shall be installed with the housing a minimum of 1/4" below but as close to the structure as possible. Where isolator hangers would be concealed by non-accessible acoustical sub ceiling, install the hangers immediately below the sub ceiling for access.

B. Vibration Isolation Types

1. Isolation Types for Floor Mounting
 - a. Single elastomer-in-shear isolators, molded mound shaped element designed for 1/4-in deflection under the imposed static load. Double elastomer-in-shear isolators shall be two such elements assembled in series or a molded element designed to provide 1/2-in deflection under the imposed static load. Elastomer-in-shear isolators shall be properly housed to prevent bulging and shall be provided with adequate facilities for bolting to equipment and floor slab.
 - b. Spring isolators shall be free standing and laterally stable and shall be equipped with acoustical-friction pads, leveling bolts and bolt holes for anchoring to floor slab. Springs shall have a minimum ratio of outside diameter to operating spring height of 0.8 and an additional travel to solid equal to 50 percent of the specified deflection. Where housed springs are specified or required, provide units with telescoping cast iron or steel housing, containing one or more springs, complete with resilient alignment insert and a minimum of 1/4" thick rubber or neoprene sound deadening pad bonded to the base of housing. Spring isolators shall have a minimum overload capacity of 200 percent of rated load, fully compressed, without deformation or failure.
 - c. Heavy load pads shall be minimum 1-1/4" thick and shall consist of a high load capacity elastomer pad and sandwiched between two 1/8-in thick steel load distribution plates capable of supporting loads up to 250 psf. For large pad area, steel plates of suitable thickness shall be provided to distribute the load.
 - d. Light load pads shall be minimum 3/4" thick solid neoprene corrugated single or laminated double, oil resistant neoprene. Pads shall be capable of loading to 50 psf.
2. Isolation Types for Suspension
 - a. Isolation hangers for suspension of equipment and piping shall have a single element of elastomer for 1/4-in deflection, a double or a single molded element for 1/2-in deflection, a single spring element with an elastomer grommet for 3/4-in deflection and a combination of an elastomer and spring elements in series for a deflection of 1" and above; elastomer and spring elements shall be contained within a structural rigid one piece steel hanger box. Springs shall have a minimum ratio of outside diameter to operating spring height of 0.8 and an additional travel to solid equal to 50 percent of the specified deflection.
 - b. The neoprene element shall have a bushing to prevent hanger rod contact with the housing box. The lower rod shall be free to swing in a 30 degree arc without touching the spring or the housing.
3. Rails and Bases - Rails and bases shall be of the following types based on the equipment and deflection required.
 - a. Rubber in shear type shall be steel rails running the full length of the supported equipment and extending under any overhang to counteract cantilever effects. The rails shall incorporate single or double deflection elastomer-in-shear fastened in place and a continuous steel floor bearing plate running the full length of each rail. The rails shall be drilled and tapped to accept the supported equipment and shall serve as a template.
 - b. Steel spring type shall be steel rails running the full length of the supported equipment and extending under any overhang to counteract cantilever effects. The rails shall consist of structural members supported by individual free standing springs. The rails shall be drilled to accept the supported equipment and shall serve as a template.

- c. Fans and their driving motors shall be mounted on structural steel channel members forming a rigid base. A common member, parallel to the V-belt drive, shall run the full length of the fan and motor and shall be of sufficient rigidity to resist the bending stress of belt pull. The structural steel base shall incorporate single or double deflection elastomer-in-shear elements or free standing springs located for proper weight distribution. The base shall be drilled and tapped to accept the fan and motor and shall serve as a template. Integral motor slide rails shall be provided and welded in place.
 - d. Inertia bases shall be of welded steel construction with concrete in-fill supplied by the installing contractor on site and shall incorporate 15M (No.4) reinforcing bars, welded 12" maximum on centers each way.
 - 1) Inertia bases for pumps shall be of sufficient size to accommodate supports for pipe elbows at pump suction and discharge connections.
 - 2) Inertia bases for fans shall include motor slide rails.
 - 3) The weight of each inertia base shall be at least equal to the weight of the equipment mounted thereon or sufficient to lower the center of gravity to or below the isolator support plane.
 - 4) Inertia bases shall be a minimum of 6" thick.
 - 5) Height-saving brackets or welded steel pockets shall be incorporated to maintain a 1" minimum clearance under each inertia base.
 - 6) Wooden formed bases leaving a concrete rather than a steel finish are not acceptable.
4. Isolation for Piping
- a. Flexible piping for systems with operating temperatures over 200 degrees F shall be stainless steel braided annular flexible hose. The hose shall be provided with an external stainless steel braid to minimize elongation under pressure. Hoses 2-1/2-in and smaller shall be threaded and hoses 3-in and larger shall be flanged. Flanged hoses shall be provided with a fixed, raised plate flange on one end and a floating flange on the other. The manufacturer shall confirm the suitability of the flexible piping for the temperature and pressure of the systems.
 - b. Rubber expansion joints shall be peroxide cured EPDM throughout with Kevlar tire cord reinforcement. Substitutions must have certifiable equal or superior characteristics. The raised face rubber flanges must encase solid steel rings to prevent pull out. Flexible cable wire is not acceptable. Sizes 1-1/2" through 14" shall have a ductile iron external ring between the two spheres. Sizes 16" through 24" may be single sphere. Sizes 3/4" through 2" may have one sphere, bolted threaded flange assemblies and cable retention. Provide control cables to prevent excessive elongation on straight connection where required. The manufacturer shall confirm the suitability of the connections for the temperature, pressure, and pipe contents for the systems. Minimum ratings through 14" shall be 250psi at 170°F and 215psi at 250°F. 16" through 24" 180psi at 170°F and 150psi at 250°F. Higher published rated connectors may be used where required.
- Safety factors shall be a minimum of 3/1. All expansion joints must be factory tested to 150% of maximum pressure for 12 minutes before shipment.

The piping gap shall be equal to the length of the expansion joint under pressure. Control rods passing through 1/2" thick Neoprene washer bushings large enough to take the thrust at 1000 psi of surface area may be used on unanchored piping where the manufacturer determines the condition exceeds the expansion joint rating without them. Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves.

- c. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3" and larger shall be flanged. Smaller sizes may have male nipples. Minimum lengths shall be as tabulated:

Flanged

3" x 12" (75 x 300mm)	6" x 18" (150 x 450mm)	12" x 24" (300 x 600mm)
4" x 12" (100 x 300mm)	8" x 18" (200 x 450mm)	14" x 30" (350 x 750mm)
5" x 18" (125 x 450mm)	10" x 18" (250 x 450mm)	16" x 32" (400 x 800mm)

Male Nipples

1/2" x 12" (12 x 300mm)	1-1/4" x 12" (32 x 300mm)	2" x 12" (50 x 300mm)
3/4" x 12" (19 x 300mm)	1-1/2" x 12" (38 x 300mm)	2-1/2" x 18" (64 x 450mm)
1" x 12" (25 x 300mm)		

- d. At equipment, hoses shall be installed on the equipment side of the shut-off valves horizontal and parallel to the equipment shafts wherever possible.

C. Rigidly Mounted Equipment

- When equipment doesn't require vibration isolation, it shall be firmly attached to the building structure.

2.03 NOISE CRITERIA

- A. The selection of pumps, fans, air handling equipment, air conditioners, heating ventilating and air conditioning machinery and mechanical equipment and the installation of the system components such as duct work and piping shall be such as not to exceed noise guidelines as defined in Chapter 49 of the 2019 edition of the ASHRAE HVAC Applications Handbook. Under no conditions shall the noise created by equipment exceed the levels of permissible noise exposures of occupational areas as established by the OSHA and other Federal, State and local safety and health standards, codes and ordinances.
- B. The equipment supplier shall provide actual noise data for the equipment submitted. If the space does not meet the required criteria, and the noise level of the equipment is found to be the cause, the equipment supplier shall be responsible for the modifications required to correct the condition.

2.04 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
- Powder coating on springs and housings
 - All hardware shall be galvanized. Metal components for exterior use shall be hot-dip galvanized.
 - Baked enamel or powder coat for metal components on isolators for interior use.
 - Color-code or otherwise mark vibration isolation devices to indicate capacity range.

PART 3 - EXECUTION

3.01 GENERAL

- A. Coordinate size, doweling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation to ensure adequate space and prevent edge breakout failures.
- B. Coordinate locations and sizes of structural supports with locations of vibration isolators (e.g., roof curbs, cooling towers, air-cooled chillers, etc.).

3.02 VIBRATION ISOLATION

- A. Block and shim all bases level so that all ductwork and piping connections can be made to a rigid system at the proper operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and the building structure.
- B. Ensure housekeeping pads have adequate space to mount equipment and isolator housings and shall also be large enough to ensure adequate edge distance for isolator anchor bolts to avoid housekeeping pad breakout failure.

3.03 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. 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.
- C. Adjust active height of spring isolators.

3.04 INSPECTION AND CERTIFICATION

- A. After installation, arrange and pay for the vibration isolation product manufacturer to visit the site to verify that the vibration isolation systems are installed and operating properly. Vibration isolation product manufacturer shall submit a certificate stating that the vibration isolation systems are installed and operating properly.
- B. Verify that isolators are adjusted with springs perpendicular to bases or housing, adjustment bolts are tightened up on equipment mountings, and hangers are not cocked.
- C. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- D. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 3. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 4. Test to 90 percent of rated proof load of device.
 - 5. Measure isolator deflection.
 - 6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- E. Remove and replace malfunctioning units and retest as specified above.
- F. Prepare test and inspection reports.

END OF SECTION

SECTION 23 0594
HVAC TESTING, ADJUSTING AND BALANCING REQUIREMENTS

PART 1 - GENERAL

1.01 PROVISIONS

- A. Requirements of Division 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration in accordance with Division 01. Those judged to be equal to that specified, will receive written approval.

1.02 DESCRIPTION

- A. Work covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawings.
- B. The work described in this section of the specifications includes, but is not limited to, the following:
 - 1. Testing, adjusting and balancing of HVAC air and water systems and equipment to demonstrate proper operation.
 - 2. Coordination with Commissioning Agent and Controls Contractor to perform functional test of HVAC systems and equipment.

1.03 RELATED WORK

- A. The following items of related work are specified and included in other sections of these specifications:
 - 1. Section 20 01 00 - General.
 - 2. Section 23 06 30 - Cleaning Mechanical Systems.
 - 3. Section 23 05 16 - Piping and Fittings.
 - 4. Section 23 05 95 - HVAC Testing, Adjusting and Balancing Procedures
 - 5. Section 23 31 13 - Sheet Metal Duct

1.04 SUBMITTALS

- A. Submit Air Balance data in accordance with Section 23 0595.

1.05 COORDINATION

- A. Advise Architect of scheduled systems testing and completed system demonstration/operation schedules so that he may witness, if desired.

1.06 QUALITY ASSURANCE

- A. The TAB (Testing and Balancing) contract shall be between the Contractor and the TAB firm.
- B. All TAB deficiencies shall be corrected when found. Any deficiencies that are (for whatever reason) not corrected immediately shall be shown in the TAB report and listed on a summary sheet in the front of the TAB report. The TAB report must be completed and accepted by the Architect before the project is accepted and all items on the summary sheet shall become punch list items with dollar values assigned to them.
- C. TAB firms shall be certified by either the AABC (Associated Air Balance Council) or the NEBB (National Environmental Balancing Bureau).
- D. Below is a partial list of TAB firms serving the State of Louisiana. This list is provided for reference only.

<u>Firm Name</u>	<u>Voice Number</u>	<u>FAX Number</u>
Coastal Air Balance, Inc. (Metairie)	504-834-4537	504-834-2361
Consolidated Balancing Services (Metairie)	504-455-4944	504-887-1972
Tech Test, Inc. of Louisiana (Baton Rouge)	225-752- 1664	225-752-0295
Acadian Air Balance, Inc. (Lafayette)	318-237-6494	318-237-6463
Certified Balance, Inc. (Monroe)	318-387-1550	318-322-4251
Edmonds Engineering Services (Shreveport)	318-687-4470	318-687-8945
Oxner Engineering (Shreveport)	318-424-9259	318-222-7254

1. Verification of TAB firm certification may be confirmed by contacting the certification agencies at the telephone numbers shown below:
 - a. NEBB at 301-977-3698
 - b. AABC at 202-737-0202
- E. At the time of final inspection, the TAB agency may be required to recheck, in the presence of the Owner's representative, specific and random selections of data, air quantities, and air motion recorded in the certified report. Points and areas for recheck shall be selected by the owner's representative. Measurements and test procedures shall be the same as approved for the initial work for the certified report. Selections for recheck, specific plus random, shall not exceed 10% of the total number tabulated in the report.
- F. Shop drawings must be provided to the TAB firm no later than 30 days after the final, approved shop drawings have been returned by the Architect to the Contractor.
- G. Coordination between the TAB firm and the Contractor shall be left strictly to those parties.
- H. The Contractor shall conduct pressure tests of all supply, return, outside air, and exhaust ductwork, constructed to a static-pressure class of 3.0 in.w.g. and above, to quantify the leakage rate of the installed systems. Unless otherwise noted, duct sealing and maximum permitted duct leakage shall meet or exceed the minimum requirements per currently adopted ANSI/ASHRAE/IESNA 90.1 Standard. Ductwork shall be fabricated and installed in accordance with SMACNA standards.

DUCT SEAL AND LEAKAGE CLASSES		
	Duct Pressure Classification (Rated Static Pressure)	
	up to 3.0 in.w.g.	higher than 3.0 in.w.g.
Required Seal Class	B	A
Required Sealing	All traverse joints and longitudinal seams.	All traverse joints, longitudinal seams and duct wall penetrations
Required Leakage Class Rectangular Metal	6	4
Required Leakage Class Round Metal	4	2

- I. Fire and smoke damper testing shall be done by the Contractor and witnessed by the TAB firm.

PART 2 - PRODUCTS

2.01 INSTRUMENTS

- A. All instruments used by the Air Balancer shall be accurately calibrated within the past calendar year and maintained in good working order.

PART 3 - EXECUTION

3.01 TESTING – GENERAL

- A. Test existing systems and equipment installed to demonstrate proper operation.
- B. Test new systems and equipment installed to demonstrate proper operation.
- C. Submit notices of readiness for testing to Architect and other appropriate people.
- D. Correct and retest work found defective when tested.
- E. Make repairs to air and water systems with new materials. Peening, doping or caulking of joints or holes will not be acceptable.

3.02 AIR SYSTEMS AND AIR DISTRIBUTION TEST AND BALANCE

- A. Perform air system test and balance in accordance with Section 23 0595.

3.03 HYDRONIC SYSTEMS AND HYDRONIC DISTRIBUTION TEST AND BALANCE

- A. Perform hydronic system test and balance in accordance with Section 23 0595.

3.04 CONDENSATE DRAIN PIPING

- A. Test plug opening to permit system to be filled with water to drain pan level. System shall hold water for four hours with no drop in water level.

3.05 RECORDS OF TESTING

- A. Maintain records of system testing and results thereof. Deliver to Architect as part of the maintenance and operation manual.

END OF SECTION

SECTION 23 0595
HVAC TESTING, ADJUSTING AND BALANCING PROCEDURES

PART 1 - GENERAL

1.01 PROVISIONS

- A. Requirements of Section 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Those judged to be equal to that specified, will receive written approval. The test and balance (TAB) agency shall be certified by either the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB).

1.02 RELATED WORK

- A. The following items of related work are specified and included in other sections of these specifications:
 - 1. Section 23 0594 - HVAC Testing, Adjusting and Balancing Requirements.

1.03 SUBMITTALS

- A. Submit seven copies of the air balance report to the Engineer for review one week (7 days) after the TAB agency completes the balancing work.
- B. Submit within 15 days after receipt of the contract, 7 copies of submittal data for the testing and balancing of the air conditioning and ventilating systems.
- C. The TAB agency shall provide proof of having successfully completed at least five projects of similar size and scope.
- D. Submit list of all instruments, including calibration certificates, to be used on the project.
- E. Submit the test and balance contract to the Professional of Record (POR) for approval within 90 days after the Air Conditioning Contractor has received his contract to proceed with the air conditioning installation to allow the TAB agency to schedule this work in cooperation with other trades involved and comply with the completion date.

1.04 REFERENCE STANDARDS

- A. Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section where cited below:
 - 1. AABC - Associated Air Balance Council.
 - 2. NEBB - National Environmental Balancing Bureau.
 - 3. SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Inc.

1.05 QUALITY ASSURANCE

- A. The TAB agency shall be one which specializes in the balancing and testing of heating, ventilating and air conditioning (HVAC) systems.
- B. All work shall be done under direct supervision of a qualified heating and ventilating certified technician employed by the agency. If requested, conduct the tests in the presence of the Engineer and/or his representative.

- C. Follow procedures and use report forms as established by the AABC.

PART 2 - PRODUCTS

2.01 INSTRUMENTS

- A. All instruments used shall be accurately calibrated and maintained in good working order. As a minimum the following shall be owned and used by the TAB Agency/Contractor:
1. 4" vane anemometers.
 2. Air velocity gauges.
 3. 10 incline vertical manometers.
 4. Magnehelic gauges.
 5. Sling psychrometers.
 6. Test thermometers.
 7. Ammeters.
 8. A.B. Strobotac.
 9. Four-point temperature analyzers.
 10. Compound test gauges.
 11. Carbon dioxide indicator fyrite.
 12. Smoke bombs.
 13. Two-way radios.
 14. Sound meter with octave bank analyzer.
 15. Flow hoods.
 16. Hot wire anemometers.
 17. Electronic rotating vane anemometers.
 18. Electronic thermometers.
 19. Electronic micromanometer.

PART 3 - EXECUTION

3.01 COORDINATION

- A. Do not begin air or hydronic system testing and balancing until systems have been completed and is in full working order.
- B. Put all heating, ventilating and air conditioning systems and equipment into full operation and continue the operation of same during each working day of testing and balancing.

3.02 BALANCING

- A. Upon installation completion of the HVAC system, the TAB agency shall perform the following test(s), compile the test data, prepare report and submit seven (7) copies of the complete report to the Professional of Record for review and approval.
- B. Test and Balance Reports shall include HVAC system designation(s), date and time of test(s), outdoor temperature, relative humidity, wind speed, and wind direction at start of test., room number or similar description for each location, HVAC system operating mode (cooling or heating), and observed deficiencies.
- C. Test and Balance Reports shall include mechanical HVAC floor plans with location of equipment, diffusers, grilles, registers, etc. showing the device identification assigned by the TAB contractor during balancing, which should match the device identification and location provided in the written TAB report for cross reference.
- D. Testing Procedure: The TAB agency shall perform the following tests, and balance system in accordance with the following requirements:
- E. Test, Adjust and Balance Procedure - Air Distribution Systems:

1. Phase I: (As Applicable)

- a. All supply and return air duct dampers are set at full open position.
- b. All diffuser and sidewall registers are set at full open position.
- c. Outside air damper is set at minimum position.
- d. All controls checked and set for full cooling cycle.
- e. Branch line splitter dampers are set to open position.
- f. Set all extractors and distribution grids in wide open positions.

2. Phase II: (As Applicable)

- a. Drill all probe holes for static pressure readings, pitot tube traverse readings and temperature readings.
- b. Check motor electrical current supply and rated running amperage of fan motors.
- c. Check fan and motor speeds.
- d. Check available adjustment tolerance.

3. Phase III: (As Applicable)

- a. Make first complete air distribution run throughout entire system and record first run statistics.
- b. Using pitot tube traverse in all main duct, branch duct downstream of VAV terminal units, supply and return, proportion all air in required amounts to the various main duct runs and branch runs.
- c. Make second complete air distribution run throughout entire system for check on proper proportion of air.

4. Phase IV: (As Applicable)

- a. Using pitot tube traverse, set all main line dampers to deliver proper amount of CFM to all areas.
- b. Using pitot tube traverse, set all branch line damper to deliver proper amount of CFM to diffusers and sidewall supply grilles in each zone.
- c. Read CFM at each outlet and adjust to meet requirements.
- d. Test and record all items to (-5% to +10%).

5. Phase V: (As Applicable)

- a. Test and adjust RPM to design requirements.
- b. Test and record motor full load amperage.
- c. Make pitot tube traverse of main supply ducts and obtain design CFM at fans.
- d. Test and record system static pressures, suction and discharge.
- e. Test and adjust system for design re-circulated air CFM.
- f. Test and adjust system for design CFM outside air.
- g. Adjust all main supply and return air ducts to proper design CFM.
- h. Adjust all zones to proper design CFM supply and return.
- i. Test and adjust each diffuser, grille and register to within (-5% to 10%) of design requirements.
- j. In order to avoid negative pressure zones in conditioned spaces to outside ambient pressure conditions, balancing return air grille flow rates in a space should be based on the supply air flow to the space being balanced less the ratio of the outside air to supply air flow rate on the respective AHU serving the space, times the supply airflow rate of the diffusers in the space.
- k. Each grille, diffuser and register shall be identified with appropriate tag and room location.

- l. Size, type and manufacturer of diffusers, griller registers and all test equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used for required calculations.
- m. Readings and tests of differs, grilles and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
- n. In cooperation with the control manufacturer's representative, set adjustments of automatically operated dampers to operate as specified, indicated and/or noted.
- o. All diffusers, grilles and registers shall be adjusted to minimize drafts in all areas.
- p. As a part of the work of this contract, the mechanical contractor shall make any changes in the pulleys, belts and dampers or the addition of dampers required for correct balance as recommended by the TAB agency at no additional cost to owner.

6. Phase VI: (As Applicable)

a. Air Handling Unit Test Reports:

1) Unit Data:

- i. Unit identification.
- ii. Location.
- iii. Make and type.
- iv. Model number and unit size.
- v. Manufacturer's serial number.
- vi. Unit arrangement and class.
- vii. Discharge arrangement.
- viii. Number of belts, make, and size.
- ix. Number of filters, type, and size.

2) Fan Motor/Sheave Data:

- i. Make and frame type and size.
- ii. Horsepower and rpm.
- iii. Volts, phase, and hertz.
- iv. Full-load amperage and service factor.
- v. Sheave make, size in inches, and bore.
- vi. Sheave dimensions, center-to-center, and amount of adjustments in inches.

3) Test Data (Indicated and Actual Values):

- i. Provide pressure (in.w.g.) and temperature (°F) profile through each section of the air handling unit(s) including, but not limited to, fans, filters, and coils, etc.
- ii. Total airflow rate in CFM.
- iii. Total system static pressure in inches wg.
- iv. Fan RPM.
- v. Outside airflow in CFM.
- vi. Return airflow in CFM.
- vii. Outside-air damper position.
- viii. Return-air damper position.
- ix. Average coil face velocity in fpm.
- x. Outside-air, wet- and dry-bulb temperatures in deg F and relative humidity.
- xi. Return-air, wet- and dry-bulb temperatures in deg F and relative humidity.
- xii. Entering-air, wet- and dry-bulb temperatures in deg F and relative humidity.
- xiii. Leaving-air, wet- and dry-bulb temperatures in deg F and relative humidity.

b. Fan Test Reports: For supply, return, and exhaust fans, include the following:

- 1) Fan Data:
 - i. Unit identification.
 - ii. Location.
 - iii. Make and type.
 - iv. Model number and unit size.
 - v. Manufacturer's serial number.
 - vi. Unit arrangement and class.
 - vii. Discharge arrangement.
 - viii. Number of belts, make, and size.
 - ix. Number of filters, type, and size.
 - 2) Fan Motor/Sheave Data:
 - i. Make and frame type and size.
 - ii. Horsepower and rpm.
 - iii. Volts, phase, and hertz.
 - iv. Full-load amperage and service factor.
 - v. Sheave make, size in inches, and bore.
 - vi. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 - 3) Test Data (Indicated and Actual Values):
 - i. Total airflow rate in CFM.
 - ii. Fan RPM.
 - iii. Discharge static pressure in inches w.g.
 - iv. Suction static pressure in inches w.g.
 - v. Total system static pressure in inches w.g.
 - vi. Air pressure drop across air filter(s) in inches w.g.
 - vii. Air pressure drop across air coil(s) in inches w.g.
- c. Electric Heating Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in air-handling and VAV terminal units, etc., include the following:
- 1) Unit Data:
 - i. System identification.
 - ii. Coil identification.
 - iii. Capacity in kW.
 - iv. Number of stages.
 - v. Connected volts, phase, and hertz.
 - vi. Rated amperage.
 - vii. Airflow rate in CFM.
 - viii. Face area in sq.ft.
 - ix. Minimum face velocity in FPM.
 - 2) Test Data (Indicated and Actual Values):
 - i. Heat output in Btuh.
 - ii. Airflow rate in CFM.
 - iii. Air velocity in FPM.
 - iv. Entering-air temperature in deg F.
 - v. Leaving-air temperature in deg F.
 - vi. Voltage at each connection.
 - vii. Amperage for each phase.

F. Test, Adjust and Balance Procedure - Hydronic Distribution System:

1. Phase I: (As Applicable)

- a. Open all valves to full position, including oil stop valves, Close bypass valves and open return line balancing cocks,
- b. Examine water in system to determine if it has been treated and is clean.
- c. Check pump rotation.
- d. Check expansion tanks to make sure they are not air bound and that the system is full of water.
- e. Check all air vents at high points of water systems to make sure they are installed properly and are operating freely. Make certain all air is removed from circulating system.
- f. Set all temperature controls so that all coils are calling for full cooling. This should close all automatic bypass valves at coil and chillers. To balance hot water coils, set system to call for full heating.
- g. Check operation of automatic bypass valves.
- h. Check and set operating temperatures of boilers, heat exchangers, and chillers to design requirements.
- i. Complete air system balance must have been accomplished before hydronic system balance begins.

2. Phase II: (As Applicable)

- a. Check water temperature at inlet side of cooling and heating coils. Note rise or drop of temperatures from source.
- b. Balance each chilled water coil.
- c. Balance each water flow measuring device off the hot water main at each floor to the total connected load (-5% to +10%).
- d. Balance each hot water end-of-the-run three way valve controlled reheat coil to (-5% to +101) (- 10% to 15% of hot coils have 3 way valves).
- e. Upon completion of flow readings and coil adjustments, mark all settings and record all data.

3. Phase III:

- a. Install pressure gauges on each coil, then read pressure drop through coil at set flow rate on call for full cooling.
- b. Coil Test Reports:
 - 1) System and air-handling unit identification.
 - 2) Entering and leaving water temperatures.
 - 3) Water pressure differential in feet of head or psig.
- c. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
 - 1) All mechanical specifications of pumps.
 - 2) Static head in feet of head or psig.
 - 3) Pump shutoff pressure in feet of head or psig.
 - 4) Actual impeller size in inches.
 - 5) Full-open flow rate in gpm.
 - 6) Full-open pressure in feet of head or psig.
 - 7) Final discharge pressure in feet of head or psig.
 - 8) Final suction pressure in feet of head or psig.
 - 9) Final total pressure in feet of head or psig.
 - 10) Final water flow rate in gpm.

- 11) Voltage at each connection.
- 12) Amperage for each phase.
- 13) Rated and actual running amperage of pump motor.

d. Chiller Test Reports:

- 1) All mechanical specifications of chiller(s).
- 2) Pressure differential in feet of head or psig.
- 3) Design flow rate in gpm.
- 4) Minimum flowrate in gpm.
- 5) Pressure differential in feet of head or psig at minimum flow.
- 6) Voltage at each connection.
- 7) Amperage for each phase.
- 8) Rated and actual running amperage of chiller(s).

e. Boiler Test Reports:

- 1) All mechanical specifications of boiler.
- 2) Operating pressure in psig.
- 3) Operating temperature in deg F.
- 4) Entering-water temperature in deg F.
- 5) Leaving-water temperature in deg F.
- 6) Number of safety valves and sizes in NPS.
- 7) Safety valve settings in psig.
- 8) High-limit setting in psig.
- 9) Operating-control setting.
- 10) High-fire set point.
- 11) Low-fire set point.
- 12) Voltage at each connection.
- 13) Amperage for each phase.
- 14) Draft fan voltage at each connection.
- 15) Draft fan amperage for each phase.
- 16) Manifold pressure in psig.

G. Provide Instrument Calibration Reports

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

H. Perform all of the air and hydronic system balancing as specified in this section.

END OF SECTION

**SECTION 23 0630
CLEANING MECHANICAL SYSTEMS**

PART 1 - GENERAL

1.01 PROVISIONS

- A. Requirements of Section 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Engineer for consideration in accordance with Section 3.3 of the Instructions to Bidders. Those judged to be equal to that specified, will receive written approval.

1.02 DESCRIPTION

- A. Work covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawings.
- B. The work described in this section of the specifications includes, but is not limited to, the following:
 - 1. Cleaning of ducts and apparatus casings.
 - 2. Cleaning of HVAC systems and piping.
 - 3. General cleanup.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 DUCTWORK AND ACCESSORIES

- A. Thoroughly clean new HVAC ductwork and accessories prior to operation of air moving equipment.

3.02 MECHANICAL SYSTEMS AND PIPING

- A. Verify that all indoor and outdoor mechanical systems including, but not limited to, ductwork, piping, equipment, etc. are clean and free of construction debris prior to equipment start-up.
- B. Thoroughly clean all new mechanical systems and piping surfaces (interior and exterior) from construction dust and debris.

3.03 FACTORY FINISHES

- A. Clean items in accordance with manufacturer's recommendations.
- B. Touch up bare places, scratches, and other minor damage to finishes. Use only factory supplied paint of matching color and formula.
- C. If finishes are badly damaged or if there are many damaged, scratched, or bare places, refinish the entire item. The Professional of Record (POR) will be the judge of whether refinishing is required.

3.04 GENERAL CLEANUP

- A. Upon completion of contract and progressively as work proceeds, clean up dirt, debris, oil materials, etc., and remove from site, keeping premises in neat and clean condition to satisfaction of the Engineer.
- B. Stoppage, discoloration, or other damage to parts of the building, its finish, or furnishings due to failure to properly clean piping systems or duct systems shall be repaired without cost to the Owner.

END OF SECTION

**SECTION 23 0700
MECHANICAL INSULATION**

PART 1 - GENERAL

1.01 PROVISIONS

- A. Requirements of Section 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number to establish standards of quality and performance and not for the purpose of limiting competition

1.02 DESCRIPTION

- A. Work covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawings.
- B. The work described in this section of the specifications includes but is not limited to the following:
 - 1. Thermal resistance "R" values used herein are expressed in units of "Hour/Degrees F/Sq. Ft./Btu per Inch of Thickness" on a flat surface at a mean temperature of 75 degrees F, unless specifically noted.

1.03 RELATED WORK

- A. The following items of related work are specified and included in other sections of these specifications:
 - 1. Section 22 0500 - Common Work for HVAC, Plumbing, and Fire Protection
 - 2. Section 23 0516 - Piping and Fittings
 - 3. Section 23 3100 - Sheet Metal Ductwork

1.04 APPLICABLE CODES AND STANDARDS

- A. INTERNATIONAL ENERGY CONSERVATION CODE (IECC)
- B. ASTM E-84.
- C. NFPA 255.
- D. NFPA 274.
- E. UL 723.
- F. NFPA 90A.
- G. NFPA 90B.
- H. ASHRAE 90.1

1.05 DEFINITIONS

- A. "Exposed" equipment, ducts and piping are areas which will be visible without removing ceilings or opening access panels. "Concealed" is not "Exposed".

1.06 SUBMITTALS

- A. Submit seven copies of all insulating materials for review by the Engineer.
- B. Product Data: Provide manufacturer's technical product data and installation instructions.
- C. Samples: Provide samples of each color, lettering style, and other graphic representation required for identification of pipes and fittings. Samples shall be evaluated by Owner and End User for final acceptance.

- D. Pipe System Identification Schedule: Include a list of all piping systems indicating a proposed nomenclature. Pipe system identification shall be evaluated by Owner and End User for final acceptance.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. CertainTeed, Owens-Corning, Johns Manville, Armacell, KFlex USA, or prior approved equivalent.

2.02 CERTIFICATION/QUALITY ASSURANCE

- A. Only products of manufacturers meeting this specification will be approved.
- B. Products shall meet applicable national, model, state and local building codes and be UL (or other recognized testing lab) listed for intended service.
- C. All insulation materials shall be delivered and stored in manufacturer's containers and kept free from dirt, water, chemical, and mechanical damage.
- D. All insulation, jacket, adhesives, coatings, sealers, tapes, shall have a flame spread rating of 25 or less and smoke development of 50 or less when tested in accordance with ASTM E-84, NFPA 225, UL 723, and further must meet the requirements of NFPA 90A where applicable and model and local buildings, plumbing, and mechanical codes.
- E. All insulation and accessories located outdoors shall be rated for the application.

2.03 MATERIAL FOR PIPE

- A. Materials for Pipe and Equipment: Provide factory pre-molded or shop or site mitered segment type insulation for pipe, pipe fittings, and valves. Fitting insulation shall be of same thickness and material as adjoining pipe insulation.
- B. All miscellaneous tanks, separators, pumps, supports, exchangers, valves, converters, expansion tanks, etc. shall be completely insulated with the appropriate material as specified below according to the respective mechanical/plumbing system.

2.04 DUCTWORK

- A. All supply, return and outside air ductwork located indoors and concealed from view shall be externally insulated with 2.0 in. thick, 1.5 pounds per cubic foot (pcf), minimum installed R-Value of 6.0, blanket flexible mineral fiber insulation conforming to ASTM C 1290, Type III. Provide insulation with factory applied all-purpose jacket with integral vapor barrier. Additionally, the first 15 feet of supply ductwork from each AHU shall be acoustically lined with maximum 2-inch fiberglass or elastomeric duct liner with a minimum installed R-Value of 8.0. Exhaust duct that is subject to sweating shall also be externally insulated with 2.0 in. thick, 1.5 pcf, minimum installed R-Value of 6.0, blanket flexible mineral fiber insulation conforming to ASTM C 1290, Type III. Provide insulation with factory applied all-purpose jacket with integral vapor barrier. All joints and seams shall be sealed with a UL181 metal tape, minimum 3" wide, approved by the insulation manufacturer. Flame spread/smoke developed rating for all insulation shall not exceed 25/50. Unless otherwise approved, acoustically lined ductwork shall also be externally insulated. Closed-cell elastomeric insulation, as manufactured by Armacell or prior approved equivalent, shall be acceptable as long as it complies with all the performance characteristics (R-Values, flame /smoke index, etc.) as required by the contract documents and currently adopted codes and standards. The R value refers to the installed thickness and NOT out-of-package. Where rectangular ducts are 20" in width (and length) or greater, duct wrap shall be additionally secured to the all sides of the duct with mechanical fasteners such as pins and speed clip washers, spaced on 18" centers maximum to prevent sagging on insulation. Before applying Duct Wrap, ducts shall be clean, dry and tightly sealed at all joints and seams. Seal all tears and punctures and other penetrations of the duct wrap facing. Elastomeric duct liner products shall include ASTM E84 test reports to confirm fire and smoke index compliance.
- B. All supply, return and outside air and exhaust ductwork located indoors and exposed to view shall be externally insulated with 2.0 in. thick, 6 pounds per cubic foot, rigid board mineral fiber insulation conforming to ASTM C 612, Type IA and IB. Provide insulation with factory

applied all-purpose foil jacket with integral vapor barrier. Additionally, the first 15 feet of supply ductwork from each AHU shall be acoustically lined with 2.0 in. thick fiberglass duct liner minimum density of 1.5 pcf with minimum installed R-Value of 8.0. Closed-cell elastomeric insulation, as manufactured by Armacell or prior approved equivalent, shall be acceptable if it complies with all the performance characteristics (R-Values, flame /smoke index, etc.) as required by the contract documents and currently adopted codes and standards. Elastomeric products shall include ASTM E84 test reports to confirm fire and smoke index compliance.

- C. All supply, return and outside air and exhaust ductwork located outdoors and exposed to weather shall be externally insulated with 2 in. thick, ASTM C552, cellular glass thermal insulation or ASTM C534/C534M Grade 1, Type II, flexible elastomeric cellular insulation with weatherproofing as specified in manufacturer's instruction. Provide polymeric laminate jacketing. Construction of laminate shall be designed to provide excellent UV resistance, high puncture, tear resistance and an excellent water vapor transmission (WVT) rate. Additionally, the first 15 feet of supply ductwork from each AHU shall be acoustically lined with 1" thick fiberglass duct liner minimum density of 1.5 pcf. Owens Corning Fiberglass 705 Series or prior approved equivalent.
- D. Grease Duct (Type 1) and condensate duct (Type 2):
 - 1. Fire-Rated Blanket: 2 layers of 1.5" thick each High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by UL and acceptable to authority having jurisdiction. Product shall be tested per ASTM E-2336. Provide stainless steel banding and install as per strict manufactures recommendations. Approved Manufacturers: Unifrax Corporation; FyreWrap Elite 1.5 or prior approved equivalent.
- E. Laboratory Exhaust Ductwork (Hazardous Exhaust): Fire-Rated Blanket, 2 layers of 1.5" thick each High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by UL and acceptable to Authority Having Jurisdiction. Product shall be tested per ASTM E-2336. Provide stainless steel banding and install in strict accordance with manufacturer's recommendations. Approved Manufacturers: Unifrax Corporation; FyreWrap Elite 1.5 or prior approved equivalent. Annular space at through penetrations at shaft enclosures shall be protected with approved material tested in accordance with ASTM E119 or UL 263 time-temperature fire conditions to prevent the passage of flame and hot gases for the time period equivalent to the fire-resistance rating of the construction penetrated.

2.05 AIR DISTRIBUTION DEVICES

- A. Grille, register and diffuser housings and/or plenums, exposed to unconditioned air above ceilings, shall be insulated with 2.2 in. thick, 0.75 pounds per cubic foot, blanket flexible mineral fiber insulation conforming to ASTM C 553, Type 1, Class B-3. Provide insulation with factory applied all-purpose jacket with integral vapor barrier. Flame spread/smoke developed rating for all insulation shall not exceed 25/50. The R value refers to the installed thickness and not out-of-package. Before applying insulation, devices shall be clean, dry and tightly sealed at all joints and seams. Seal all tears and punctures and other penetrations of the insulation facing. Owens Corning all service fiber glass wrap or prior approved equal. Closed-cell elastomeric insulation, as manufactured by Armacell or prior approved equivalent, shall be acceptable as long as it complies with all the performance characteristics (R-Values, flame /smoke index, etc.) as required by the contract documents and currently adopted codes and standards. Elastomeric products shall include ASTM E84 test reports to confirm fire and smoke index compliance.

2.06 DOMESTIC COLD SUPPLY, HOT SUPPLY AND HOT RETURN WATER PIPING AND EQUIPMENT

- A. Glass Fiber:
 - 1. Provide factory-formed, fiberglass pipe insulated factory-jacketed "system" type similar to Owens-Corning 25 ASJ heavy density, one-piece, dual temperature, pre-molded insulation.

2. Insulate all valves, fittings and flanges with 3-pound density fiberglass insulation to a thickness equal to the adjacent piping insulation and covered with pre-molded 25/50 rated PVC fitting, vapor sealed with Childers CP-30 vapor barrier mastic. PVC jacketing for pipe, fittings, and equipment located outdoors shall be white color, high-impact, weatherable and UV-resistant as manufactured by Johns Manville, Type Zeston Series or prior approved equivalent.
 3. Jacket to be fiberglass reinforced kraft paper with aluminum foil.
 4. Insulation thickness, based on insulation having a conductivity not exceeding $0.27 \text{ Btu} \cdot \text{inch}/(\text{h} \cdot \text{ft}^2 \cdot ^\circ\text{F})$, shall be as follows:
 - a. Domestic cold water piping – 1" thick
 - b. Domestic hot water supply and return (90°F through 140°F) – 1" thick
 - c. Domestic hot water supply and return (141°F through 180°F) – 1.5" thick
 5. Cover all piping, valves, fittings and all miscellaneous devices with .030" thick color coded PVC jacket and pre-molded PVC fittings secured per manufacturer's recommendations.
- B. Elastomeric:
1. Seal longitudinal seams and end joints with manufacturer's recommended adhesive (i.e. Armacell 520 or HT625) to eliminate openings in insulation that allow passage of air to surface being insulated.
 2. Elastomeric products shall include ASTM E84 test reports to confirm fire and smoke index compliance.
 3. Insulation Installation on Pipe Flanges:
 - a. Install pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - d. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 4. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install mitered sections of pipe insulation.
 - b. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 5. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - b. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
 - d. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

2.07 HEATING HOT WATER PIPING AND EQUIPMENT

A. Glass Fiber:

1. Provide factory-formed, fiberglass pipe insulated factory-jacketed "system" type similar to Owens-Corning 25 ASJ heavy density, one-piece, dual temperature, pre-molded insulation.
2. Insulate all valves, fittings and flanges with 3-pound density fiberglass insulation to a thickness equal to the adjacent piping insulation and covered with pre-molded 25/50 rated PVC fitting, vapor sealed with Childers CP-30 vapor barrier mastic. PVC jacketing for pipe, fittings, and equipment located outdoors shall be white color, high-impact, weatherable and UV-resistant as manufactured by Johns Manville, Type Zeston Series or prior approved equivalent.
3. Jacket to be fiberglass reinforced kraft paper with aluminum foil.
4. Insulation thickness, based on insulation having a conductivity range between 0.21 and 0.28 Btu · inch/(h · ft² · °F) at a mean rating temperature of 100°F, shall be as follows:
 - a. 1.5" thick for pipe sizes 1-1/2" diameter and larger
 - b. 1" thick for pipe sizes 1-1/4" diameter and smaller

B. Elastomeric:

1. Seal longitudinal seams and end joints with manufacturer's recommended adhesive (i.e. Armacell 520 or HT625) to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Elastomeric products shall include ASTM E84 test reports to confirm fire and smoke index compliance.
3. Insulation Installation on Pipe Flanges:
 - a. Install pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - d. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
4. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install mitered sections of pipe insulation.
 - b. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
5. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - b. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
 - d. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

- C. Cover all piping, valves, fittings and all miscellaneous devices with .030" thick color-coded PVC jacket and pre-molded PVC fittings secured per manufacturer's recommendations.

2.08 CHILLED WATER PIPING AND EQUIPMENT

- A. Chilled water piping, valves and fittings shall be insulated with cellular glass, ASTM C552, Type II, Class 2.
 - 1. Insulation thickness, based on insulation having a conductivity range between 0.21 and 0.27 Btu · inch/(h · ft² · °F) at a mean rating temperature of 75°F shall be as follows:
 - a. 1.0" thick for pipe sizes 1.5" diameter and smaller
 - b. 1.5" thick for pipe sizes between 2" and 4" diameter
 - c. 2" thick for pipe sizes 6" diameter and larger
- B. Provide a factory-applied, all-purpose jacket. Cover all chilled water piping, valves, fittings and all miscellaneous devices with 30 mil (0.03") thick color-coded PVC jacket and pre-molded PVC fittings secured per manufacturer's recommendations. PVC jacketing for pipe, fittings, and equipment located outdoors shall be white color, high-impact, weatherable and UV-resistant as manufactured by Johns Manville, Type Zeston Series or prior approved equivalent.
- C. Chiller evaporator barrel shall be insulated with cellular glass, ASTM C552, Type II, Class 2. Insulation shall be a minimum 3 inches thick. Provide a factory-applied, all-purpose jacket. Cover with .030" thick color-coded PVC jacket and remolded PVC fittings secured per manufacturer's recommendations.
- D. Closed-cell elastomeric insulation, as manufactured by Armacell or prior approved equivalent, shall be acceptable if it complies with all the performance characteristics (R-Values, flame /smoke index, etc.) as required by the contract documents and currently adopted codes and standards. Elastomeric products shall include ASTM E84 test reports to confirm fire and smoke index compliance.

2.09 CONDENSATE DRAIN

- A. Condensate drain piping shall be insulated with flexible, closed-cell, elastomeric cellular thermal insulation, ASTM C 534, Type I and II. Minimum insulation thickness shall be 1.0 inch with a conductivity range between 0.21 and 0.26 BTU-in/(hr-ft²-°F) at a mean rating temperature of 50°F. Elastomeric products shall include ASTM E84 test reports to confirm fire and smoke index compliance.

2.10 REFRIGERANT PIPING AND EQUIPMENT

- A. Refrigerant piping shall be insulated with flexible, closed-cell, elastomeric cellular thermal insulation in compliance with ASTM C 534, Type I and II. Thickness shall meet or exceed the minimum requirements for energy efficiency per the currently adopted International Energy Conservation Code and ASHRAE 90.1 Standard. Minimum insulation thickness shall be 1.0 inch with a conductivity range between 0.21 and 0.26 BTU-in/(hr-ft²-°F) at a mean rating temperature of 50°F. Elastomeric products shall include ASTM E84 test reports to confirm fire and smoke index compliance.
- B. Provide smooth, (plain mill) finish, aluminum jacketing for all insulated refrigerant piping located outdoors. Minimum aluminum jacket thickness shall be 0.016 inches. Jacketing shall comply with the requirements of ASTM C1729 as manufactured by Johns Manville or prior approved equivalent.
- C. All liquid and suction lines shall be insulated continuously from a point at least 6 inches inside the air handling unit to the suction service valve at the compressor.
- D. Piping design must allow for adequate spacing of insulation thickness and cross ventilation around the insulation. Do not crowd the insulation.

2.11 STORM DRAIN

- A. All storm drain piping shall be externally insulated with minimum 2.0 in. thick, 0.75 pounds per cubic foot, blanket flexible mineral fiber insulation conforming to ASTM C 553, Type 1, Class B-3. Closed-cell elastomeric insulation, as manufactured by Armacell or prior

approved equivalent, shall be acceptable if it complies with all the performance characteristics (R-Values, flame /smoke index, etc.) as required by the contract documents and currently adopted codes and standards. Elastomeric products shall include ASTM E84 test reports to confirm fire and smoke index compliance.

2.12 DRAIN PIPING COLLECTING COLD CONDENSATE

- A. Condensate drain piping shall be insulated with flexible cellular insulation, ASTM C 534, Type I, with vapor barrier. Thickness shall be a minimum of 0.5 inches.

2.13 STEAM AND STEAM CONDENSATE PIPING AND EQUIPMENT

- A. Glass Fiber:
1. Provide factory-formed, fiberglass pipe insulated factory-jacketed "system" type similar to Owens-Corning 25 ASJ heavy density, one-piece, dual temperature, premolded insulation. Insulation thickness shall be as follows:
 - a. 4" thick for pipe sizes 2-1/2" and above
 - b. 3" thick for pipe sizes 1" to 2"
 - c. 2-1/2" thick for pipe sizes 3/4" and below
 2. Insulate all valves, fittings and flanges with 3-pound density fiberglass insulation to a thickness equal to the adjacent piping insulation and covered with premolded 25/50 rated PVC fitting, vapor sealed with Childers CP-30 vapor barrier mastic.
 3. Jacket to be fiberglass reinforced kraft paper with aluminum foil.

2.14 COLOR IDENTIFICATION OF PIPE AND FITTINGS

- A. Unless otherwise noted, all insulated pipe and fittings shall utilize 0.030" PVC jacket. Jackets for fittings shall be pre-molded PVC. Unless otherwise noted, the PVC jacket shall utilize the color described in table below for each utility. PVC jacketing for pipe, fittings, and equipment located outdoors shall be white color, high-impact, weatherable and UV-resistant as manufactured by Johns Manville, Type Zeston Series, or prior approved equivalent. If the pipe and fittings are not insulated, the utility shall be painted. Coordinate specific colors with Owner and End-User. A list of proposed colors is provided in table below for reference use. Sherwin Williams one coat KEM Prime, and 2 coats Sherwin Williams Dura Plate 235 Industrial or prior approved equal.

120 DEGREE DOMESTIC HOT WATER	LIGHT RED
140 DEGREE DOMESTIC HOT WATER	PURPLE
DOMESTIC COLD WATER	GREEN
NATURAL GAS	YELLOW
FIRE PROTECTION	RED
CHILLED WATER	BLUE
CONDENSER WATER PIPING	LIGHT GREEN
HEATING HOT WATER	LIGHT RED
FUEL OIL	LIGHT YELLOW
HIGH PRESSURE STEAM	WHITE
LOW PRESSURE STEAM	WHITE
HIGH PRESSURE STEAM CONDENSATE	GREY
LOW PRESSURE STEAM CONDENSATE	GREY

PART 3 - EXECUTION

3.01 GENERAL

- A. Insulation shall be applied in a workmanlike manner by experienced, qualified workmen.
- B. Insulation shall not be applied until all pressure testing has been completed, inspected and released for insulation applications.
- C. No pipe insulation shall be cut where a hanger is located. If hangers have been installed which violates this strict requirement notify the Architect immediately.
- D. All surfaces shall be clean and dry when covering is applied. Covering to be dry when installed and before and during application of any finish, unless such finish requires specifically a wetted surface for application.
- E. All adhesives, cements, and mastics shall be compatible with materials applied and shall not attack materials in either wet or dry state.
- F. Install insulation using professional insulators who have adequate experience and ability.
- G. Exposed-to-view insulation shall have a well tailored appearance.

3.02 DUCTWORK INSULATION

- A. Install insulation after ductwork has been inspected and tested unless otherwise authorized by the AE.
- B. Provide insulation with vapor barrier when air conveyed may be below ambient temperature.
- C. Provide continuity of insulation and vapor barrier through penetrations unless code prohibits.
- D. Provide continuity of insulation and vapor barrier through hangers and at supports.
- E. Provide high-density inserts at hangers and supports to prevent compression of insulation.
- F. Provide protection at each corner of insulated ductwork extending to or through floors or curbs. Construct of sheet metal angle. Extend minimum 12" above floor/curb.
- G. Additional Requirements for Outdoor Installations:
 - 1. Provide external insulation with vapor retarder jacket. Cover with outdoor jacket finished with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
 - 2. Ensure that insulation jacket is sealed waterproof, vapor tight.
 - 3. Provide tightly fitted metal lagging with overlapped sections properly oriented for prevailing weather.
 - 4. Mechanically attach lagging sections. Seal all seams and penetrations watertight.

3.03 DOMESTIC WATER PIPING INSULATION

- A. Insulation end joints to be tightly butted together and the longitudinal seam stapled closed with outward clinch staples, 3" on center. Before stapling, heavily coat the underside of the jacket overlap with vapor barrier adhesive, Childers CP-30 or equal. Locate all longitudinal seams out of sight. Cover end joints with factory furnished, 4" wide vapor barrier striping tapes, heavily coating the underside and secure with vapor barrier adhesive. Seal all ends of pipe insulation with vapor barrier mastic at valves, fittings, flanges, direct hanger contacts and every butt joint of straight run.
- B. Valves, Fittings and Flanges: Insulate all valves, fittings and flanges with 3-pound density, flexible fiberglass insulation to a thickness equal to the adjacent piping insulation and covered with premolded 25/50 rated PVC fittings, vapor sealed with Childers CP-30 vapor barrier mastic.
- C. Hangers and Rollers: At hangers and rollers where the pipe is supported by the insulation, the Insulation Contractor shall install an insert section of wood cellular glass or calcium silicate on all piping 3" diameter and larger inside the vapor barrier. The length of insert section shall not be less than 12" for all piping through 8" and 18" on pipe size 10" and over. Coat the insert section with vapor barrier mastic to provide an effective vapor seal. Provide a protective shield covering of 18 gauge for piping 6" and smaller and 16 gauge for 8" and

- larger, galvanized steel placed centrally between the insert section of all hangers and rollers. Shield shall cover half of the insulation and have a length of not less than 12" on pipe sizes up to 8" and 18" on pipe sizes 10" and over.
- D. Cover all exposed outdoor insulated piping with Childers Deep Corrugated sheets, 1-1/4" size ,3003 aluminum .024 inch thick, smooth finish. Strap with 3/8" wide, .020 inches thick, 3003 aluminum strapping. Use aluminum panhead type A" slotted screws. Use Childers aluminum fitting jackets/covers were applicable. Seal all seams and openings with Childers Chill-joint CP-70 sealant.
 - E. Insulate and weather protect all valves and fittings.

END OF SECTION

**SECTION 23 0900
INSTRUMENTATION AND CONTROLS FOR HVAC**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Requirements of Division 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.
- B. This Section includes the Building Management System (BMS), also known as Building Automation System (BAS), control equipment for HVAC systems and components, including open protocol control components for terminal heating and cooling equipment.
- C. All work of this Section shall be coordinated and provided by the HVAC Controls Contractor.
- D. All 120V and 24V control power, wiring/conduit, and accessories associated with the BMS shall be provided by the Control Contractor. This includes, but is not limited to, transformers, relays, sensors, valves, actuators, dampers, controllers, etc. This shall also include any control or power (120V) cabling for equipment manufacturers packaged control panels, sensors, relays, etc.
- E. The control Contractor shall provide interconnecting cabling between the equipment and the manufacture's control panel.
- F. Related Sections include the following:
 - 1. Basic Mechanical Requirements.
 - 2. Adjustable Frequency Drives.
 - 3. Air Handling Equipment.
 - 4. Test and Balance.
 - 5. Basic Electrical Requirements.
 - 6. Cables, Low Voltage 600 Volts and below.
 - 7. Wiring Devices
 - 8. Basic Electrical Materials.
 - 9. Uninterruptable Power Supply.
 - 10. Emergency Systems.

1.02 SCOPE

- A. The new building bas system shall integrate into existing siemens central campus automation system and shall allow for complete seamless read/write capability without any delay for all necessary software programming modifications and control.
- B. Provide a new, open protocol, building management system (BMS) with web-based supervisory controller. Provide all gateways, interfaces, programming, etc. required for a complete and fully operational BMS. Any new IP addresses required for integration to any enterprise IT system(s) shall be provided to the Controls Contractor by the Owner.
- C. Control Contractor shall provide any new software and hardware required for monitoring, commissioning, and programming of field services through remote computer access.
- D. Contractor to provide IT connection (min. CAT6 cable) from the IT network switch to the BMS head-end.
- E. The BMS system scope of work shall include all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, raceways, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in this Section which are required for the complete, fully functional and commissioned BMS.

- F. Provide a complete, neat, and workmanlike installation. Contractor shall only assign employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards, and configurations for this Project.
- G. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.
- H. The BMS as provided shall incorporate, at minimum, the following integrated features, functions, and services:
 - 1. Operator information, alarm management and control functions.
 - 2. Enterprise-level information and control access.
 - 3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
 - 4. Diagnostic monitoring and reporting of BMS functions.
 - 5. Offsite monitoring and management access.
 - 6. Energy management
 - 7. Standard applications for terminal HVAC systems.

1.03 DEFINITIONS

- A. ARP: Address Resolution Protocol
- B. ASC: Application Specific Controller.
- C. BMS or BAS: Building Management System or Building Automation System
- D. CAC: Custom Application Controller.
- E. CSMA/CD: Carrier Sense Multiple Access/Collision Detect
- F. DDC: Direct Digital Control
- G. DDE: Dynamic Data Exchange
- H. FTT: Free Topology Transceivers
- I. GUI: Graphical User Interface
- J. HMI: Human Machine Interface
- K. HVAC: Heating, Ventilation, and Air Conditioning
- L. LAN: Local Area Network
- M. MER: Mechanical Equipment Room
- N. ODBC: Open DataBase Connectivity
- O. PID: Proportional, Integral, Derivative
- P. PES: Portable Engineering Station
- Q. POT: Portable Operator's Terminal
- R. SQL: Structured Query Language
- S. UDP: User Datagram Protocol
- T. UNC: Universal Network Controller
- U. VAV: Variable Air Volume Box

1.04 SYSTEM DESCRIPTION

- A. Furnish all labor, materials, and equipment necessary for a complete and operating Building Management System (BMS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only. All controllers furnished in this section shall communicate on a peer-to-peer bus over an open protocol bus (Examples: BACnet, MODBUS).
 - 1. System architecture shall fully support a multi-vendor environment and be able to integrate third party systems via existing vendor protocols.

2. The use of configurable or programmable controllers that require additional software tools or tools that require a specific license brand to operate for post-installation maintenance shall not be acceptable.
 3. The BMS server shall host all graphic files for the control system.
 4. Provide individual graphics including, but not limited to, the building, the chilled water system, steam to hot water heat exchanger, each air handling system and each control and monitoring point provided under this project into the existing BMS workstation. Also provide an individual graphic for each fan coil unit, blower coil unit, terminal unit, etc. Graphics shall display fans, coils, dampers, and all sensing and control points associated with the particular unit. Program floor plan type graphics of this project showing the location of controlled equipment to all full graphic penetration of the BMS system data via the system mouse. All BMS monitoring and control points shall be displayed in a graphic. All BMS set points shall be adjustable through a graphic.
 5. Owner shall receive all Administrator level login and passwords for engineering toolset at first training session. The Owner shall have full licensing and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BMS.
 6. All JACE hardware licenses and certificates shall be stored on local MicroSD memory card employing encrypted "safe boot" technology.
- B. OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURE
1. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system utilizing Open protocols in one open, interoperable system.
 2. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. Physical connection of any BACnet control equipment, such as chillers, shall be via Ethernet or IP.
 3. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
 4. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.
 5. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
 6. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.
- C. Complete temperature control system to be DDC with electronic sensors and electronic/electric actuation of Mechanical Equipment Room (MER) valves and dampers and electronic actuation of terminal equipment valves and actuators as specified herein. The BMS is intended to seamlessly connect devices throughout the building regardless of subsystem type, i.e. variable frequency drives, low voltage lighting systems, electrical circuit breakers, power metering and card access should easily coexist on the same network channel.
- D. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage.
1. This data shall reside on a supplier-installed server for all database access.
 2. Systems requiring proprietary database and user interface programs shall not be acceptable.
 3. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network.
 4. Systems employing a "flat" single tiered architecture shall not be acceptable.

- E. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work. Certified technician shall have a minimum of 5 years of installation experience with the manufacturer and shall provide documentation in the bid and submittal package verifying longevity of the installing company's relationship with the manufacturer. Supervision, calibration, and checkout of the system shall be by the factory office. Supplier shall have an in-place support facility within 25 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.
- F. If required by the Owner, provide a Portable Operator's Terminal (POT) color display personnel computer, software, and interfaces to provide uploading/downloading of Custom Application Controller and Application Specific Controllers databases, monitoring and overrides of all controller physical input/output points, and editing of controller resident time schedules. POT connectivity shall be via digital wall sensor connected to controller.

1.05 INSTALLATION OF PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Ductwork Accessories:
 - 1. Automatic Dampers
 - 2. Airflow Stations
 - 3. Terminal Unit Controls
- B. Hydronic Piping:
 - 1. Control Valves.
 - 2. Flow/Level Switches.
 - 3. Temperature Sensor Wells and Sockets.
 - 4. Flowmeters.

1.06 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION

- A. HVAC Equipment and Controls:
 - 1. 100% Outside Air Blower Coil Units
 - 2. Fan Coil Units
 - 3. Variable Frequency Drives
 - 4. Systems Status (On/Off)
 - 5. System Alarms
- B. Fire Alarm Systems.
 - 1. Smoke Detectors (HVAC Equipment and Ductwork)
 - 2. Fire/Smoke Dampers.
- C. Lighting Control Systems
- D. Access Control Security Systems
- E. Security Control Units and Intelligent Devices.
- F. Plumbing Equipment Control Systems.

1.07 REFERENCES

- A. All work shall conform to the following Codes and Standards, as applicable:
 - 1. National Fire Protection Association (NFPA) Standards.
 - 2. International Mechanical Code 2012
 - 3. International Building Code 2012
 - 4. National Electric Code (NEC) and applicable local Electric Code.
 - 5. Underwriters Laboratories (UL) listing and labels.
 - 6. UL 864 UUKL Smoke Control
 - 7. UL 268 Smoke Detectors.
 - 8. UL 916 Energy Management
 - 9. NFPA 70 - National Electrical Code.
 - 10. NFPA 90A - Standard For The Installation Of Air Conditioning And Ventilating Systems.

11. NFPA 92A and 92B Smoke Purge/Control Equipment.
12. NFPA 101 - Life Safety Code
13. Factory Mutual (FM).
14. American National Standards Institute (ANSI).
15. National Electric Manufacturer's Association (NEMA).
16. American Society of Mechanical Engineers (ASME).
17. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
18. Air Movement and Control Association (AMCA).
19. Institute of Electrical and Electronic Engineers (IEEE).
20. American Standard Code for Information Interchange (ASCII).
21. Electronics Industries Association (EIA).
22. Occupational Safety and Health Administration (OSHA).
23. American Society for Testing and Materials (ASTM).
24. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
25. Americans Disability Act (ADA)
26. ANSI/ASHRAE Standard 195-2012 (BACnet)

- B. In the case of conflicts or discrepancies, the more stringent regulation shall apply.
- C. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.08 SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 1. Each control device labeled with setting or adjustable range of control.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
 3. Details of control panel faces, including controls, instruments, and labeling.
 4. Written description of sequence of operation.
 5. Schedule of dampers including size, leakage, and flow characteristics.
 6. Schedule of valves including close-off and flow characteristics.
 7. Trunk cable schematic showing programmable control unit locations and trunk data conductors.
 8. Input/Output points list. Listing of connected data points, including connected control unit and input device.
 9. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
 10. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
- C. External Interface Files: XIF files or object diagrams for each DDC system component (Custom Application Controller and Application Specific Controller) proposed.
- D. ANSI / ASHRAE™ Standard 135-2008, BACnet PIC Statement: Proof of Compliance Level 3 or higher is required to protect building owner by reducing future maintenance and expansion costs.
- E. Samples: For each color required, of each type of thermostat cover.
- F. Software and Firmware Operational Documentation, include the following:
 1. Engineering, Installation, Operation and Maintenance manuals.
 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.

3. Device address list.
 4. Printout of software application and graphic screens.
 5. Licenses, guarantee, and warranty documents for all equipment and systems.
- G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- H. Maintenance Data: For systems to include in maintenance manuals specified in Division 01. Include the following:
1. Maintenance instructions and lists of spare parts for each type of control device.
 2. Interconnection wiring diagrams with identified and numbered system components and devices.
 3. Recommended device inspection and calibration periods, cleaning methods, cleaning materials and calibration tolerances.
 4. Calibration records and list of set-points.
- I. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- J. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors. Revise Shop Drawings to reflect actual installation and operating sequences.
- K. Provide submittal with all GUI screen captures for approval after all above information has been reviewed.

1.09 QUALITY ASSURANCE

- A. Bids by wholesalers and non-franchised contractors shall not be acceptable.
- B. The system manufacturer shall, as a minimum, manufacture and supply the Custom Application Controller, Application Specific Controller, Graphical User Interface, damper actuators, and valve actuator assemblies.
- C. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the direct employment of the temperature control system manufacturer.
- D. The BMS Contractor shall have a complete maintenance and support services on a 24 hour, 7-day-a-week basis.
- E. The Building Management System Contractor shall have a full service facility within 25 miles of the project that is staffed with engineers trained in Integrating Interoperable Systems and technicians fully capable of providing BACnet instructions and routine emergency maintenance service on all system components.
- F. Mechanical equipment manufacturers desiring to provide DDC type controls as factory mounted equipment shall provide a separate bid for their products less all controls, actuators, valve assemblies and sensors, which are specified to be provided by the BMS Contractor.
- G. 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.
- H. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."
- I. Comply with National Electric Code, UL-916 Energy Management Systems, BACnet protocol for DDC system control components, ULC, FCC Part 15, subpart J, Class B Computing Devices.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

1.11 COORDINATION

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

- B. Coordinate equipment from other divisions including "Intrusion Detection," "Lighting Controls," "Motor-Control Centers," "Panelboards," and "Fire Alarm" to achieve compatibility with equipment that interfaces with those systems.
- C. Coordinate supply of conditioned electrical circuits for control units and operator workstation.
- D. Coordinate location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Cast-in-Place Concrete.
- E. Coordinate with the Owner's IT department on locations for UNC's, ethernet communication cabling and TCP/IP addresses.

1.12 WARRANTY AND MAINTENANCE

- A. All components, system software, and parts furnished and installed by the BMS Contractor shall be guaranteed against defects in materials and workmanship for a minimum of 5 years after substantial completion. Labor to repair, reprogram, or replace these components shall be furnished by the BMS Contractor at no charge during normal working hours during the warranty period. Materials furnished but not installed by the BMS Contractor shall be covered to the extent of the product only. Installation labor shall be the responsibility of the trade Contractor performing the installation. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the owner's request for warranty service within 24 hours standard working hours.

1.13 RECORD DOCUMENTATION

- A. Operation and Maintenance Manuals
 - 1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BMS provided:
 - a) Table of contents.
 - b) Record drawings. Computer Aided Drawings (CAD) record drawings shall represent the installed condition of the system and incorporate all information supplied with the approved submittal.
 - c) Manufacturer's product data sheets or catalog pages for all products including software.
 - d) System Operator's manuals.
 - e) Archive copy of all site-specific databases and sequences.
 - f) BMS network diagrams.
 - g) Interfaces to all third-party products and work by other trades.
- B. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

1.14 OWNERSHIP OF PROPRIETARY MATERIAL

- A. The owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software. All project developed software and documentation shall become the property of the Owner. These include, but are not limited to project graphic images, record drawings, project database, project specific application programming code, and all other associated documentation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Schneider Electric – TAC I/A Series
2. Siemens – Desigo Series
3. Johnson Controls – Metasys Series
4. Automated Logic – WebCTRL Series
5. Or prior approved equivalent.

2.02 BAS SERVER HARDWARE - Minimum Computer Configuration (Hardware Independent)

- A. Central Server. Owner shall provide a dedicated BAS server with configuration that includes the following components as a minimum:
 1. Processor: Intel Xeon CPU E5-2640 x64 (or better), compatible with dual- and quad-core processors.
 2. Operating System: Windows 10, 64-bit Windows 8.1 Enterprise, Windows Server 2012 Standard and 2012 R2 Standard.
 3. Memory: 1 GB or more recommended for large systems, 4 GB or more recommended for the Windows 64-bit version.
 4. Hard Drive: 4 GB minimum, more recommended depending on archiving requirements.
 5. Display: Video card and monitor capable of displaying 1024 x 768 pixel resolution or greater.
 6. Network Support: Ethernet adapter (10/100 Mb with RJ-45 connector).
 7. Connectivity: Full-time high-speed ISP connection recommended for remote site access (i.e. T1, ADSL, cable modem)

2.03 BAS SERVER - SYSTEM OVERVIEW

- A. The BAS server shall communicate using Ethernet and TCP/IP.
- B. The BAS server software shall support at least the following server platforms (Windows 7, 8.1, Server 12). The BAS server software shall be developed and tested by the manufacturer of the system stand-alone controllers and network controllers/routers.
- C. Software Components: All software shall be the most current version. All software components of the BAS system software shall be provided and installed as part of this project. BAS software components shall include:
 1. Server Software, Database and Graphical User Interface.
 2. 5-year software maintenance license. Labor to implement not included.
 3. Embedded System Configuration Utilities for future modifications to the system and controllers.
 4. Embedded Graphical Programming Tools.
 5. Embedded Direct Digital Control software.
 6. Embedded Application Software.

2.04 DDC EQUIPMENT

- A. The new DDC equipment for this project shall interface completely with this existing BMS system.
- B. GUI Server Application Software: Input/output capability from operator station for monitoring and controlling all of the points listed in the input/output point list. The operator shall be able to monitor and access all points by means of clear concise English names without having to understand or reference hardware point locations or controller programs.
 1. Operating System: The GUI shall run on Microsoft Windows Workstation, Windows 10, or later.
 2. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.

3. The GUI shall have the contract drawing floor plans with associated HVAC equipment, including but not limited to, chillers, pumps, air-handling units, automatic valves, and sensors. The GUI shall be clear and easy to view without any distorted images. Provide color coded zones that indicate individual zones. Provide separate individual screens that will show detailed operation of existing and new equipment.
4. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:
 - a) Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
 - b) Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
 - c) Graphics shall support layering and each graphic object shall be configurable for assignment to one a layer. A minimum of six layers shall be supported.
 - d) Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
 - e) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - f) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.
7. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
 - a) Create, delete or modify control strategies.
 - b) Add/delete objects to the system.
 - c) Tune control loops through the adjustment of control loop parameters.
 - d) Enable or disable control strategies.
 - e) Generate hard copy records or control strategies on a printer.
 - f) Select points to be alarmable and define the alarm state.
 - g) Select points to be trended over a period of time and initiate the recording of values automatically.
8. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.
9. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

10. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
11. Alarm Console
 - a) The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
 - b) When the Alarm Console is enabled, a separate alarm notification window will supercede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

B. GRAPHICAL PROGRAMMING

1. The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in all control modules. Any system that does not use a drag and drop method of graphical icon programming shall not be accepted. All systems shall use a GPL method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.
2. Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.
3. Graphic Sequence: The clarity of the graphic sequence shall be such that the operator has the ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming shall be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.
4. GPL Capabilities: The following is a minimum definition of the capabilities of the Graphic Programming software:
 - a) Function Block (FB): Shall be a collection of points, microblocks and wires which have been connected together for the specific purpose of controlling a piece of HVAC equipment or a single mechanical system.
 - b) Logical I/O: Input/Output points shall interface with the control modules in order to read various signals and/or values or to transmit signal or values to controlled devices.
 - c) Microblocks: Shall be software devices that are represented graphically and may be connected together to perform a specified sequence. A library of microblocks shall be submitted with the control contractors bid.
 - d) Wires: Shall be Graphical elements used to form logical connections between microblocks and between logical I/O.
 - e) Reference Labels: Labels shall be similar to wires in that they are used to form logical connections between two points. Labels shall form a connection by reference instead of a visual connection, i.e. two points labeled 'A' on a drawing are logically connected even though there is no wire between them.
 - f) Parameter: A parameter shall be a value that may be tied to the input of a microblock.

- g) Properties: Dialog boxes shall appear after a microblock has been inserted which has editable parameters associated with it. Default parameter dialog boxes shall contain various editable and non-editable fields, and shall contain 'push buttons' for the purpose of selecting default parameter settings.
- h) Icon: An icon shall be graphic representation of a software program. Each graphic microblock has an icon associated with it that graphically describes its function.
- i) Menu-bar Icon: Shall be an icon that is displayed on the menu bar on the GPL screen, which represents its associated graphic microblock.
- j) Live Graphical Programs: The Graphic Programming software shall support a 'live' mode, where all input/output data, calculated data and set points shall be displayed in a 'live' real-time mode.

C. PORTABLE ENGINEERING STATIONS

- 1. Provide a Portable Engineering Station (PES) color display personal computer, software, and interfaces to provide; uploading/downloading of Custom Application Controller and Application Specific Controllers databases, monitoring and overrides of all controller physical input/output points, and editing of controller resident time schedules. PES connectivity shall be via digital wall sensor connected to controller.
- 2. The Portable Engineering Station shall use Visio and all programming shall be graphical.
- 3. The Portable Engineering Station shall be able to access any other controller on that segment of the LAN.
- 4. Connection of a PES to the Custom Application Controller or Application Specific Controller shall not interfere with normal network operation in any way, prevent alarms from being transmitted or centrally initiated commands from being executed.
- 5. If the PES cannot be used for both the CAC's and ASC's, provide, in addition to the PES, the separate color display personal computer(s), software, and interfaces required to provide full PES functionality for both the CAC's and ASC's.
- 6. Hardware for the PES shall consist of the following:
 - a. Intel Xeon CPU E5-2640 x64 (or better), compatible with dual- and quad-core processors.
 - b. Large 15" UXGA active matrix (TFT) display
 - c. 2 GB or more recommended for large systems, 8 GB or more recommended for the Windows 64-bit version.
 - d. 60 GB internal hard drive
 - e. Ethernet 10/1000
 - f. Full-time high-speed ISP connection recommended for remote site access (i.e. T1, ADSL, cable modem).
 - g. Video card and monitor capable of displaying 1024 x 768 pixel resolution or greater.
- 7. Functionality of the PES connected to any CAC or ASC shall include:
 - a. Uploads and downloads of CAC and ASC Controller databases.
 - b. Uploads and downloads of CAC and ASC BACnet values.
 - c. Editing of BACnet values for minor equipment operational parameters (including minimum on/off and delay times, changeover values, minimum position setpoints, etc.). All such mechanical equipment editable values shall contain internal CAC and ASC Controller safety range limits to prevent accidental entry of out of range or invalid values.
 - d. Monitoring and overrides of all controller physical input/output points including timed overrides that automatically revert back to their normal value.
 - e. Display of digital sensor values including diagnostics and calibration
 - f. Editing of controller time/date.
 - g. Editing and overrides of resident Controller time schedules.

B. CONTROL UNITS GENERAL:

- 1. Provide an adequate number of control units to achieve monitoring and control of all data points specified and necessary to satisfy the sequence of operation for all mechanical systems shown on the plans. Provide a minimum of one separate controller for each AHU

or other HVAC system. Multiple DDC controllers may control one system provided that all points associated with individual control loops are assigned to the same DDC controller. Points used for control loop reset such as outside air or space temperature are exempt from this requirement. Each of the following panel types shall meet the following requirements.

2. Controllers shall be suitable for the anticipated ambient conditions.
 - a. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at -40°F to 140°F and 5 to 95% RH, non condensing.
 - b. Controllers used in conditioned ambient space shall be mounted in dustproof enclosures, and shall be rated for operation at 32°F to 122°F and 5 to 95% RH, non condensing.
3. Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
4. Memory: The Control Units shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
5. Diagnostics: The Building Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall assume a predetermined failure mode and generate an alarm notification.
6. Immunity to power and noise: Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 ft.
7. Automatic staggered restart of field equipment after restoration of power and short cycle protection.

C. SYSTEM NETWORK CONTROLLER (SNC)

1. These controllers are designed to manage communications between the programmable equipment controllers (PEC), application specific controllers (ASC) and advanced unitary controllers (AUC) which are connected to its communications trunks, manage communications between itself and other system network controllers (SNC) and with any operator workstations (OWS) that are part of the BAS, and perform control and operating strategies for the system based on information from any controller connected to the BAS.
2. The controllers shall be fully programmable to meet the unique requirements of the facility it shall control.
3. The controllers shall be capable of peer-to-peer communications with other SNC's and with any OWS connected to the BAS, whether the OWS is directly connected, connected via cellular modem or connected via the Internet.
4. The communication protocols utilized for peer-to-peer communications between SNC's will be BACnet, TCP/IP and SNMP. Use of a proprietary communication protocol for peer-to-peer communications between SNC's is not allowed.
5. The SNC shall employ a device count capacity license model that supports expansion capabilities.
6. The SNC shall be enabled to support and shall be licensed with the following Open protocol drivers (client and server) by default:
 - a. BACnet
 - b. MODBUS
 - c. SNMP
 - d. KNX
7. The SNC shall be capable of executing application control programs to provide:
 - a. Calendar functions.
 - b. Scheduling.
 - c. Trending.
 - d. Alarm monitoring and routing.
 - e. Time synchronization.
 - f. Integration of controller data.

- g. Network management functions for all SNC, PEC and ASC based devices.
- 8. The SNC shall provide the following hardware features as a minimum:
 - a. Two 10/100 Mbps Ethernet ports.
 - b. Two Isolated RS-485 ports with biasing switches.
 - c. 1 GB RAM
 - d. 4 GB Flash Total Storage / 2 GB User Storage
 - e. Wi-Fi (Client or WAP)
 - f. USB Flash Drive
 - g. High Speed Field Bus Expansion
 - h. -20-60°C Ambient Operating Temperature
 - i. Integrated 24 VAC/DC Global Power Supply
 - j. MicroSD Memory Card Employing Encrypted Safe Boot Technology
- 9. The SNC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers.
- 10. The SNC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via cellular modem, or wide-area network.
 - a. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
 - 1) Alarm.
 - 2) Return to normal.
 - 3) To default.
 - b. Alarms shall be annunciated in any of the following manners as defined by the user:
 - 1) Screen message text.
 - 2) Email of complete alarm message to multiple recipients.
 - 3) Pagers via paging services that initiate a page on receipt of email message.
 - 4) Graphics with flashing alarm object(s).
 - c. The following shall be recorded by the SNC for each alarm (at a minimum):
 - 1) Time and date.
 - 2) Equipment (air handler #, access way, etc.).
 - 3) Acknowledge time, date, and user who issued acknowledgement.

The SNC shall support the following security functions.
 - d. Module code signing to verify the author of programming tool and confirm that the code has not been altered or corrupted.
 - e. Role-Based Access Control (RBAC) for managing user roles and permissions.
 - f. Require users to use strong credentials.
 - g. Data in Motion and Sensitive Data at Rest be encrypted.
 - h. LDAP and Kerberos integration of access management.
- 11. The SNC shall support the following data modeling structures to utilize Search; Hierarchy; Template; and Permission functionality:
 - a. Metadata: Descriptive tags to define the structure of properties.
 - b. Tagging: Process to apply metadata to components
 - c. Tag Dictionary
- 12. The SNC shall employ template functionality. Templates are a containerized set of configured data tags, graphics, histories, alarms... that are set to be deployed as a unit based upon manufacturer's controller and relationships. All lower level communicating controllers (PEC, AUC, AVAV, VFD...) shall have an associated template file for reuse on future project additions.
- D. Custom Application Control Units:
 - 1. Modular, comprising processor board with programmable, nonvolatile, RAM/EEPROM memory for custom control applications. CAC's shall be provided for Roof Top Units, Air Handling Units, and other applications as shown on drawings and shall have published BACnet application source code, device resource files and external interface definitions
 - 2. Units monitor or control each input/output point; process information; and at least 50

expressions for customized HVAC control including mathematical equations, boolean logic, PID control loops with anti-windup, sequencers, timers, interlocks, thermostats, enthalpy calculation, counters, interlocks, ramps, drivers, schedules, calendars, OSS, compare, limit, curve fit, and alarms.

3. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Automatic communications loss detection to maintain normal control functionality regardless of available network communications.
 - b. Discrete/digital, analog, and pulse input/outputs.
 - c. Monitoring, controlling, or addressing data points.
 - d. Local energy management control strategies
4. Local operator interface port provides for download from and connection to portable workstation.
5. Communication: The Custom Application Controller shall communicate via the Primary Controller Network between BMS Controllers and other devices. CAC's shall communicate with the Building Controller and ASC's at a baud rate of not less than 78.8K baud using BACnet communications protocol.
6. Power fail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming.
7. Human Machine Interface (HMI): Provide a HMI for each controller that shall control and monitor the air temperature, pressure, fan status, manual override, and set-point adjustment. HMI shall be LCD display. HMI shall also be able to control the local equipment upon the loss of communication with the UNC.

E. Application Specific Control Units:

1. Single board construction comprising processor board with programmable, nonvolatile, RAM/EEPROM memory for custom control and unitary applications. ASCs shall be provided for HVAC equipment as shown on the drawings. ASCs shall be based on the microprocessor working with the ASCs standalone control program.
2. Units monitor or control each input/output point; process information; and download from the operator station.
3. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Peer to peer primary network level communications with automatic communications loss detection to maintain normal control functionality regardless of available network communications.
 - b. Discrete/digital, analog, and pulse input/output.
 - c. Monitoring, controlling, or addressing data points.
 - d. Appropriate BACnet profiles for specific unitary applications.
 - e. Internal customizable safeties and limits to prevent third party tools from providing improper and unrealistic inputs to ASC's.
4. Local operator interface port located on ASC and ASC sensor provides for download from or upload to portable workstation. All devices shall be accessible from either port.
5. Communication: ASC's shall communicate with the Building Controller and CAC's at a baud rate of not less than 78.8K baud using BACnet communications protocol.
6. ASC units monitor or control each input/output point; process information; and at least 50 expressions for customized HVAC control including mathematical equations, boolean logic, PID control loops with anti-windup, sequencers, timers, interlocks, thermostats, counters, interlocks, compare, limit, and alarms.
7. Power fail Protection - All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming.
8. All ASC Controller setpoints shall be digital display setpoints with dual setpoint limits (integral hard limits which the user cannot exceed above and below and independent soft limits which are hidden from the user). All digital setpoints shall be network retentive after

- power outages and after replacement of sensor.
9. Human Machine Interface (HMI): Provide a HMI for each controller that shall control and monitor the temperature, pressure, fan status, manual override, setpoint adjustment. HMI shall be LCD display. HMI shall also be able to control the local equipment upon the loss of communication with the UNC.

F. ASC ROOM SENSOR

1. The ASC Sensor shall provide room temperature value and humidity to the ASC.
2. The ASC Sensor shall connect directly to the ASC and shall not utilize any of the I/O points of the controller.
3. The ASC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive.
4. There shall be one ASC Sensor per floor wired so that the communication jack will provide for a connection to the communication trunk to which the ASC controller is connected.
5. By connecting to this ASC Sensor, the connected controller, and all other devices on the communication trunk shall be accessible by the Portable Engineering Station.
6. The ASC Sensor shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of the electronics or esthetic covering.
7. The ASC Sensor shall allow for the customization of the color on the esthetic covering as a standard offering.
8. The ASC Sensor shall be supplied in the following manner:
 - a. LCD display for viewing up to four possible displays, each showing a current value in the ASC or on the network.
 - b. Tenant override to allow timed override of unoccupied to occupied mode of operation.
 - c. LED indication of override state
 - d. Icons shall be utilized to represent sensor and controller function status, affording independence from a single language for use interface.
 - e. User interface with the ASC Sensor shall be provided as a configurable function, and shall offer password protection for access to network variable editing.
 - f. Six buttons to provide the following functions:
 - 1) Selection and adjustment of up to four setpoints (Setpoint Key)
 - 2) Selection of up to two HVAC modes (Mode Key)
 - 3) Selection of up to two fan modes (Fan Key)
 - g. ASHRAE 95 compliance (LCD display and sub-base functionality)
 - h. The room sensor shall provide access to additional diagnostic data from a sensor-user keypad request. This Diagnostic mode is displayed on the LCD screens and includes separate displays for the controllers:
 - 1) Subnet and Node Address
 - 2) Errors
 - 3) Alarms
 - 4) Temperature Offset

G. ASC – VAV CONTROLLER FUNCTIONALITY

Controls shall be microprocessor based Pressure Independent Variable Air Volume Digital Controllers, as shown in the drawings. The VAV ASC shall be a single integrated package consisting of a microprocessor, power supply, damper actuator, differential pressure transducer, field terminations, and application software. An alternate model shall be offered that allows for direct connectivity to an external actuator for those applications that employ a non-butterfly style damper configuration. All input/output signals shall be directly hardwired to the VAV ASC controller. The internal actuator shall employ a manual override that allows for powered or non-powered adjustment of the damper position. In all cases, the controller shall automatically re-sume proper operation following the return of power to, or control by the ASC. Programming, configuring and/or troubleshooting of input/output signals shall be easily executed through the ASC sensor or GP tool connected at the wall sensor location.

1. The VAV ASC control algorithms shall be designed to limit the frequency of damper repositioning, to assure a minimum 10-year life from all components. The VAV ASC shall provide internal differential pressure transducer for pressure independent applications with an accuracy of $\pm 5\%$. Flow through transducers requiring filter maintenance are not acceptable. The VAV ASC shall provide zone control accuracy equal to or better than $\pm 1^\circ\text{F}$. Systems providing control accuracies greater than $\pm 1^\circ\text{F}$ are not acceptable. With the submittal package, contractor shall provide performance data that verifies control accuracy of the VAV ASC.
2. All input/output signals shall be directly hardwired to the VAV ASC. A minimum of one input point of the VAV ASC shall employ a universal configuration that allows for flexibility in application ranging from dry contact, resistive, to voltage/current sourced inputs. If a universal point is not available, a minimum of one input point (each) of the dry contact, resistive and analog voltage/current types must be provided on every controller. The outputs of the ASC shall be of the relay and universal analog form. All digital outputs shall be relay type. ASC devices utilizing non-relay outputs shall provide an interface relay for all points. All analog outputs shall be programmable for their start points and span to accommodate the control devices. Configuration of all I/O points shall be accomplished without physical hardware jumpers, switches or settings. Troubleshooting of input/output signals shall be easily executed with the Graphical Programming tool or a volt-ohm meter (VOM). All I/O points shall be utilized by the local ASC or shall be available as I/O points for other controllers throughout the network.
3. The FMCS contractor shall provide VAV ASC to the VAV box manufacturer, for factory mounting. The VAV terminal unit supplier shall include in its price all costs for mounting of VAV ASC controller, connection of actuator to damper shaft, wiring of device power, wiring of VAV ASC to fan (fan powered terminal) and wiring to electric reheat coils or reheat valve actuator as specified on drawing.
4. The VAV terminal manufacturer shall provide a multi-point, averaging, differential pressure sensor mounted on the inlet to each VAV box. The VAV terminal unit manufacturer shall supply a line to low voltage transformer, of sufficient capacity, to power the VAV ASC plus all reheat valves and/or contactors and fan circuits associated with the VAV terminal and actuator assemblies. The FMCS contractor shall provide all reheat control valves to the mechanical contractor for mounting and piping. The FMCS contractor shall provide and install all wiring between the valve and VAV ASC controller and between the room sensor and the VAV ASC controller.
5. A minimum of two input points of the VAV ASC shall employ a universal configuration that allows for flexibility in application ranging from dry contact, resistive, to voltage/current sourced inputs. If these universal points are not available, a minimum of two input point (each) of the dry contact, resistive and analog voltage/current types must be provided on every controller.
6. Power fail Protection - All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming.

H. VAV BOX ROOM SENSOR

1. The VAV Box Room Sensor shall provide room temperature value and humidity to the controller.
2. The VAV Box Room Sensor shall connect directly to the controller Box and shall not utilize any of the I/O points of the controller.
3. The VAV Box Room Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive.
4. There shall be one VAV Box Room Sensor per floor wired so that the communication jack will provide for a connection to the communication trunk to which the VAV controller is connected.
5. By connecting to this VAV Box Room Sensor, the connected controller, and all other devices on the communication trunk shall be accessible by the Portable Engineering Station.
6. The VAV Box Room Sensor shall be provided in a modular configuration that allows for

- the rough in of all wiring without the presence of the electronics or esthetic covering.
7. The VAV Box Room Sensor shall allow for the customization of the color on the esthetic covering as a standard offering.
 8. The VAV Box Room Sensor shall be supplied in the following manner:
 - a. LCD display for viewing up to four possible displays, each showing a current value in the VAV Box or on the network.
 - b. Tenant override to allow timed override of unoccupied to occupied mode of operation.
 - c. LED indication of override state
 - d. Icons shall be utilized to represent sensor and controller function status, affording independence from a single language for use interface.
 - e. User interface with the VAV Box Room Sensor shall be provided as a configurable function, and shall offer password protection for access to network variable editing.
 - f. Six buttons to provide the following functions:
 - 1) Selection and adjustment of up to four setpoints (Setpoint Key)
 - 2) Selection of up to two HVAC modes (Mode Key)
 - 3) Selection of up to two fan modes (Fan Key)
 - g. ASHRAE 95 compliance (LCD display and sub-base functionality)
 - h. Power fail Protection - All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming.
 - i. The VAV Box Room Sensor shall provide access to additional diagnostic data from a sensor-user keypad request. This Diagnostic mode is displayed on the LCD screens and includes separate displays for the controllers:
 - 1) Subnet and Node Address
 - 2) Errors
 - 3) Alarms
 - 4) Temperature Offset
- I. ASC VAV –AIR BALANCING
- Through the Portable Engineering Station, the VAV ASC shall support a fully prompted Air Balance sequence. The Portable Engineering Station shall, when connected through the wall sensor, access the connected VAV ASC unit. The air balance sequence shall step the balancing contractor through the checkout and calibration of the VAV ASC. Upon completion of the balancing sequence, the flow values presented by the VAV ASC shall match those observed by the balancing contractor's measurement equipment. Additionally, upon completion of the air balance, the balance settings shall be archived for future use if the controller were to require replacement. Systems not able to provide a formatted air balance Graphical Pro-gramming Tool shall provide an individual full time during the Air-balancing process to assure full balance compliance.
- J. ASC – FAN COIL UNIT, BLOWER COIL UNIT, UNIT VENTILATOR, HEAT PUMP, PACKAGED ROOFTOP CONTROLLER FUNCTIONALITY AS APPLICABLE
- Controls shall be microprocessor based as shown in the drawings or indicated in the sequence of operations. The ASC shall be a single integrated package consisting of a microprocessor, power supply, field terminations, and application software. The units shall be started and stopped from the BMS. A low limit protection thermostat in the mixed air section of the unit shall close down the outdoor air damper, open coil valves, and alarm the BMS when a temperature below 38°F (adjustable) is sensed. All input/output signals shall be directly hardwired to the ASC controller. In all cases, the controller shall automatically resume proper operation following the return of power to, or control by the ASC.
1. All ASCs must have an operating temperature range -40°F to 140°F and 5 to 95% RH, non-condensing, because they are located in the proximity of extreme temperatures (hot water/steam pipes or the outdoor air).
 2. All ASCs shall have capability for both ASHRAE Cycle II and ASHRAE Cycle III fully

tested and validated. Bidder shall provide application documentation for ASC ASHRAE cycle II and III compliance including sequence of operation and controller program. The control program shall also be fully customizable in the field to accommodate any local or project specific requirements that may be required.

3. All duct averaging sensors for ASCs must be true continuous averaging units that sense the mean temperature over the complete length of the sensor end to end. Sensors that provide four or nine sensing points, which may be accurate due to air temperature stratifications, are not acceptable.
4. All ASCs shall be easily replaceable for ease of future maintenance and to minimize downtime.
5. Power Fail Protection - All system set-points, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming.
6. The outputs of the ASC shall be of the relay Form C and universal analog form. All digital outputs shall be relay type Form C. ASC devices utilizing non-relay outputs shall provide an interface relay for all points. All analog outputs shall be programmable for their start points and span to accommodate the control devices.

K. LANs:

1. Capacity for a minimum of 64 client workstations connected to multiuser, multitasking environment with concurrent capability to access DDC network or control units.
2. Enterprise Network LAN
 - a. Media: Ethernet (IEEE 802.3), peer-to-peer CSMA/CD, operating at 10 or 100 Mbps, cable 10 Base-T, UTP-8 wire, category 5
3. Primary Controller Network LAN
 - a. Media: BACnet, peer to peer, FTT-10 operating at 78.8K.
4. Secondary Network LAN (If Required)
 - a. Media: BACnet, peer to peer, FTT-10 operating at 78.8K
5. Remote Connection
 - a. ISDN, ADSL, T1 or dial-up connection, monthly charges paid by building owner.

L. Software:

1. Controller and System HVAC Applications
 - a. Update to latest version of software at Project completion. Include and implement capabilities from the control units as documented by the HVAC sequence of operations.
2. Controller and Network Setup Software
 - a. Network managements tools for the ANSI / ASHRAE™ Standard 135-2008, BACnet protocol shall be provided including a network learn function, bindings, service pins, winks, and diagnostics.

2.02 CONTROL PANELS

A. Local Control Panels: Unitized NEMA 1 cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.

1. Fabricate panels of 0.06-inch thick, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish.
2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
3. Door-Mounted Equipment: Flush-mount (on hinged door) manual switches, including damper-positioning switches, changeover switches, thermometers, and gages.
4. Provide ON/OFF power switch with over-current protection for control power sources to each local panel.

2.03 SENSORS

- A. Electronic Temperature Sensors: Vibration and corrosion resistant; for wall, immersion, or duct mounting.
 - 1. Resistance Temperature Detectors: Platinum, thermistor, or balco
 - a. Accuracy: Plus or minus 0.2 percent at calibration point; thermistors shall have a maximum 5 year drift of no more than .225°F maximum error of no more than .36°F
 - b. Wire: Twisted, shielded-pair cable
 - c. Insertion Elements in Ducts: Single point, 6 inches long; use where not affected by temperature stratification or where ducts are smaller than 4 sq. ft.
 - d. Averaging Elements in Ducts: 60 inches, long, flexible for use where prone to temperature stratification or where ducts are larger than 4 sq. ft.; 264 inches long, flexible for use where prone to temperature stratification or where ducts are larger than 16 sq. ft; length per manufacturer recommendations.
 - e. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
 - f. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight with weatherproof boxes.
 - g. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
 - 2. Humidity Sensors: Bulk polymer sensor element.
 - a. Accuracy: 2 percent at 10-90% RH with linear output.
 - b. Room Sensors: Range of 0 to 100 percent relative humidity
 - c. Duct and Outside-Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
 - 3. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - a. Accuracy: $\pm 1\%$ of full scale with repeatability of 0.5 %.
 - b. Output: 4 to 20 mA, 0-5 vDC, 0-10 vDC.
 - c. Building Static-Pressure Range: -.1 to .1, -0.25 to 0.25, -.5 to .5, -1.0 to 1.0 IN WC., jumper selectable.
 - d. Duct Static-Pressure Range: 0 to 1, 0 to 2.5, 0 to 5, 0 to 10 IN WC., jumper adjustable
 - 4. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.
- B. Equipment operation sensors as follows:
 - 1. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 IN WC
 - 2. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 8 to 60 psig.
 - 3. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.
- C. Water-Flow Switches: Pressure-flow switches of bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless-steel or bronze paddle. For chilled-water applications, provide vaporproof type.
- D. Flow Meters for Closed-Loop Chilled Water and Heating Hot Water Systems
 - 1. The flow meter shall be hand-insertable up to 400 psi. The flow meter shall have two contra-rotating axial turbines, with electronic impedance-based sensing and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion.
 - 2. Wetted metal components shall be 316L SS. Optional 316L SS construction is required for HW applications operating over 250°F and for any application in non-metallic pipe. The maximum operating temperature shall be 280°F, 300°F peak.
 - 3. Each flow meter shall be individually wet-calibrated against a primary volumetric standard that is accurate to within 0.1% and traceable to NIST. The manufacturer's certificate of calibration shall be provided with each flow meter. Accuracy shall be within $\pm 0.5\%$ of

- rate at the calibrated velocity, within $\pm 1\%$ of rate over a 10:1 turndown (3.0 to 30 ft/s) and within $\pm 2\%$ of rate over a 50:1 turndown (from 0.4 to 20 ft/s).
4. The flow meter shall include integral analog output(s), 4-20 mA, 0-10V, or 0-5V. Bi-directional meters shall include an isolated contact closure output for direction.
 5. The flow meter shall be covered by the manufacturer's two year warranty.
 6. Provide manufacturer's recommended display module for local or remote indication of flow rate (GPM) and total flow (gallons per day).
 7. Provide an ONICON Model FB-1210 Dual Turbine Flow Meter complete with all installation hardware necessary to enable insertion and removal of the meter without system shutdown.
- E. Flow Meters for Make-up Water, Pumped Condensate, Boiler Feed and Boiler Blow-down
1. The flow meter shall be hand-insertable up to 400 psi. Turbine rotation shall be detected by electronic impedance-based sensing (non-magnetic).
 2. Wetted metal components shall be 316L SS. The meter shall be rated for maximum operating temperature shall be 280°F, 300°F peak.
 3. Each flow meter shall be individually wet-calibrated against a primary volumetric standard that is accurate to within 0.1% and traceable to NIST. The manufacturer's certificate of calibration shall be provided with each flow meter. Accuracy shall be within $\pm 0.5\%$ of rate at the calibrated velocity, within $\pm 1\%$ of rate over a 10:1 turndown (3.0 to 30 ft/s) and within $\pm 2\%$ of rate over a 50:1 turndown (from 0.4 to 20 ft/s).
 4. The flow meter shall include an integral isolated dry-contact switch output that is factory scaled to meet the frequency requirements of the building management system based on application-specific flow rates.
 5. The flow meter shall be covered by the manufacturer's two year warranty.
 6. Provide manufacturer's display module with auxiliary dry-contact switch output for local or remote indication of flow rate (GPM) and total flow (gallons per day). Note: When optional flow display is specified, use flow meter Models F-1100 and F-1200 in lieu of F-1130 and F-1230.
 7. Provide an ONICON Model F-1130 Turbine Flow Meter complete with all installation hardware necessary to enable insertion and removal of the meter without system shutdown. For pipe sizes 2 1/2" and larger with less than 30 straight pipe diameters available, provide an ONICON Model F-1230 Flow Meter, with two contra-rotating axial turbines, and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion.
- F. Flow Meters for Open-Loop Condenser Water Systems
1. The flow meter shall be hand-insertable up to 400 psi. The flow meter shall be bi-directional, electromagnetic sensing type, with electronic impedance-based sensing and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion.
 2. Wetted metal components shall be 316L SS. Optional 316L SS construction is required for HW applications operating over 250°F and for any application in non-metallic pipe. The maximum operating temperature shall be 280°F, 300°F peak.
 3. Each flow meter shall be individually wet-calibrated against a primary volumetric standard that is accurate to within 0.1% and traceable to NIST. The manufacturer's certificate of calibration shall be provided with each flow meter. Accuracy shall be within $\pm 0.5\%$ of rate at the calibrated velocity, within $\pm 1\%$ of rate over a 10:1 turndown (3.0 to 30 ft/s) and within $\pm 2\%$ of rate over a 50:1 turndown (from 0.4 to 20 ft/s).
 4. The flow meter shall include integral analog output(s), 4-20 mA, 0-10V, or 0-5V. Bi-directional meters shall include an isolated contact closure output for direction.
 5. The flow meter shall be covered by the manufacturer's two year warranty.
 6. Provide manufacturer's display module for local or remote indication of flow rate (GPM) and total flow (gallons per day).
 7. Provide an ONICON Model FB-3500 Flow Meter or prior approved equivalent; complete with all installation hardware necessary to enable insertion and removal of the meter without system shutdown.

2.04 THERMOSTATS

- A. Room Temperature Sensors with Integral Display
 - 1. Room sensors shall be constructed for either surface or wall box mounting.
 - 2. Room sensors shall have an integral LCD display and four button keypad with the following capabilities:
 - a. Display room temperature.
 - b. Display and adjust room comfort set-point.
 - c. Display and adjust fan operation status.
 - d. Timed override request push button with LED status for activation of after-hours operation.
 - e. Display controller mode.
 - f. Password selectable adjustment of set-point and override modes.
- B. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch type, or equivalent solid-state type, with heat anticipator, integral manual on-off-auto selector switch.
 - 1. Equip thermostats, which control electric heating loads directly, with off position on dial wired to break ungrounded conductors.
 - 2. Dead Band: Maximum 2°F.
- C. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature, with copper capillary and bulb, unless otherwise indicated.
 - 1. Bulbs in water lines with separate wells of same material as bulb.
 - 2. Bulbs in air ducts with flanges and shields.
 - 3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit, adequately supported.
 - 4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
 - 5. On-Off Thermostat: With precision snap switches, with electrical ratings required by application.
 - 6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.
- D. Fire-Protection Thermostats: UL listed with fixed or adjustable settings to operate at not less than 75°F above normal maximum operating temperature, with the following:
 - 1. Reset: Manual with control circuit arranged to directly shutdown appropriate equipment and provide remote annunciation at the GUI
- E. Room Thermostat Cover Construction:
 - 1. Set-Point Adjustment: Concealed or exposed
 - 2. Set-Point Indication: Concealed or exposed
 - 3. Thermometer: Optional
 - 4. Color: Neutral
 - 5. Orientation: Vertical or horizontal
- F. Room thermostat accessories include the following:
 - 1. Insulated Bases: For thermostats located on exterior walls.
 - 2. Thermostat Guards: As specified in tamper prone areas
 - 3. Adjusting Key: As required for calibration and cover screws.
 - 4. Set-Point Adjustment: 1/2-inch diameter, adjustment knob.
- G. Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
 - 1. Bulb Length: Minimum 20 feet
 - 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- H. Electric High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.
 - 1. Bulb Length: Minimum 20 feet.
 - 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

- I. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig., and cast housing with position indicator and adjusting knob.

2.05 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action under all environmental conditions (temperature, low power voltage fluctuations, tight seal damper design, maximum air and water flow forces).
 1. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
 2. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2": Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 3. Spring-Return Motors for Valves Larger Than NPS 2-1/2": Size for running and breakaway torque of 150 in. x lbf.
 4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
- B. Electronic Valve Actuators: Direct-coupled type non hydraulic designed for minimum 100,000 full-stroke cycles at rated torque. The actuator shall have rating of not less than twice the thrust needed for actual operation of the damper or valve.
 1. Coupling: V-bolt and V-shaped, toothed cradle.
 2. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 3. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
 4. Actuators shall have the ability to be tandem mounted.
 5. All spring-return actuators shall have a manual override. Complete manual override shall take no more than 10 turns.
 6. Power Requirements (Two-Position Spring Return): 24V ac or dc, Maximum 10VA.
 7. Power Requirements (Modulating): Maximum 15 VA at 24V ac.
 8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
 9. Temperature Rating: -22°F to 140°F.
 10. Run Time: 200 seconds open, 40 seconds closed.
 11. All actuators shall have a 5 year warranty
 12. Valves:
 - a. Size for torque required for valve close-off at maximum pump differential pressure (regardless of water loop system pressures).
 - b. Valve and Actuators shall come from the factory fully assembled.
 - c. Spring Return Manual Override shall come with a 10° Valve Preload to assure tight close off.

2.06 CONTROL VALVES

- A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system and or dead head of the pump, unless otherwise indicated.
- B. Globe Valves NPS 2" and Smaller: Bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure. Valves shall have allowable media temperature of 20°F to 281°F to assure that the valve packing will have a long life (valves will narrower allowable media temperatures have no reserve packing capability for long term watertight seal).
- C. Globe Valves NPS 2-1/2" and Larger: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.

- D. Hydronic system globe valves shall have the following characteristics:
 - 1. Rating: Class 125 for service at 125 psig. and 250°F operating conditions.
 - 2. Internal Construction: Replaceable plugs and seats of stainless steel or brass.
 - a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.
 - b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.
 - 3. Sizing: 3 psig. maximum pressure drop at design flow rate.
 - 4. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics. Operators shall close valves against pump shutoff head.
- E. Butterfly Valves: 200 psig. maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
 - 1. Body Style: Wafer, Lug, or Groove
 - 2. Disc Type: Nickel-plated ductile iron, Aluminum bronze, Elastomer-coated ductile iron, Epoxy-coated ductile iron.
 - 3. Sizing: 1 psig. maximum pressure drop at design flow rate.
- F. Automatic Flow - Pressure Independent Control Valves
 - 1. Application: Automatic flow pressure independent (PICV) control valves for HVAC equipment including, but not limited to, air handling unit cooling and heating coils, pumps, VAV terminal unit coils, boilers, chillers, etc.
 - 2. Acceptable Manufacturers: Danfoss or prior approved equivalent.
 - 3. Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Valve bodies shall meet ASME B16.34 or ASME B16.15 pressure and temperature class ratings based on the design operating temperature and 150 percent of the system design operating pressure. Unless otherwise specified or shown, valve leakage shall meet FCI 70-2 Class IV leakage rating (0.01 percent of valve Kv). Unless otherwise specified or shown, valves shall be two way pressure independent globe-style bodies. Unless otherwise specified:
 - a. bodies for valves 2 inches and smaller shall be brass or bronze, with union ends.
 - b. bodies for valves 2 to 3 inches shall be of brass, bronze or cast iron.
 - c. bodies for valves 2.5 inches and larger shall be provided with flanged-end connections.
 - d. valve and actuator combination shall be normally open or normally closed as shown.
 - 4. The valve shall be two way globe style with integrated differential pressure control regulator. Where indicated modulating proportional valve application shall utilize controller or actuator to match required control signal to complement controlled coil heat transfer characteristic for linear control. The valve shall;
 - a. provide integrated pressure regulator; regulator to control pressure across control valve orifice.
 - b. provide regulator incorporating EPDM diaphragm, stainless steel spring and pressure control disc. Pressure control seat shall be brass construction with vulcanized EPDM.
 - c. provide counterbalance of supply pipe pressure to return pipe pressure across diaphragm to prevent diaphragm damage when control valve is closed
 - d. provide user adjustable maximum flow within valve control range; Adjustment method shall indicate percentage of valve flow range and utilize spring locked method of adjustment.
 - e. regulate internal control valve differential pressure to provide 100% control valve authority.
 - f. shall have linear flow characteristic.
 - g. provide back seated globe design to allow service of packing under pressure without leakage.

- h. provide entering to leaving pressure control across low flow 1/2" valve in size from 2.3PSI to 60PSI.
 - i. provide entering to leaving pressure control across valves 1/2" to 3/4" in size from 5PSI to 60PSI.
 - j. provide entering to leaving pressure control across valves 1" to 1-1/4" in size from 5PSI to 60PSI.
 - k. provide entering to leaving pressure control across valves 1.5" to 10" in size from 4PSI to 60PSI.
 - l. provide union connections for 1/2" to 2" valve sizes
 - m. provide ANSI flanged connections for 2.5" to 10" valve sizes
 - n. utilize stainless steel internal trim with brass globe and seat.
 - o. utilize threaded actuator connection
 - p. flow requirements shall be sized to provide nominal body selection no more than one size smaller to corresponding nominal pipe connection.
 - 1) 1/2" bodies shall be utilized for 1/2" and may be utilized for 3/4" pipe connection and flow less than 5 GPM.
 - 2) 3/4" bodies may be utilized for 3/4" pipe and may be applied to 1" pipe connection with flow less than 7.5 GPM.
 - 3) 1" bodies may be utilized for 1" pipe and may be applied to 1 1/4" pipe connection with flow less than 12 GPM.
 - 4) 1 1/4" bodies may be utilized for 1 1/4" and may be applied to 1 1/2" pipe connection with flow less than 17.5 GPM.
 - 5) 1 1/2" bodies may be utilized for 1 1/2" pipe and may be applied to 2" pipe connection with flows less than 33 GPM.
 - 6) Flows less than 55 GPM may use 2" bodies.
 - 7) Flows less than 85 GPM may use 2 1/2" bodies.
 - 8) Flows less than 120 GPM may use 3" bodies.
 - 9) Flows less than 165 GPM may use 4" bodies.
 - 10) Flows less than 395 GPM may use 5" bodies.
 - 11) Flows less than 640 GPM may use 6" bodies.
 - 12) Flows less than 830 GPM may use 8" bodies.
 - 13) Flows less than 1230 GPM may use 10" bodies.
5. Control valves utilized for controlled flows (e.g. Duct-Coil and Terminal-Unit-Coil; Hot and Chilled Water Systems) shall be proportionally modulated. Control valve may be integrated into coil assembly package. Coil assembly package shall;
- a. Provide integrated ball valve and wye pattern strainer. Strainer shall be #20 mesh. Strainer valve shall provide pressure and temperature measurement port with integrated positive shutoff gland seal. Strainer valve shall have plugged 1/4" female NPT accessory port. Strainer valve shall provide integrated 1/4" ball drain valve with cap and common hose connection. Strainer valve shall provide integrated union connection and tailpiece. Strainer valve shall be provided to match flow requirements for connected control valve.
 - b. Provide union connection entering and leaving piping of coil. Union connection fitting shall include three accessory 1/4" female NPT tapped ports for test and other HVAC devices. Provide pressure and temperature measurement port with integrated positive shutoff gland seal in unions entering and leaving coil. Provide manual air vent in union leaving coil. Provide 1/4" threaded plugs in all unused union ports. Provide union nut, tailpiece and o-ring seal, or appropriate connectors to flexible piping.
 - c. Provide ball shutoff valve with integrated union. Valve shall provide pressure and temperature measurement port with integrated positive shutoff gland seal. Valve shall have plugged 1/4" female NPT accessory port. Provide union nut, tailpiece and o-ring seal, or appropriate connectors to flexible piping.
 - d. Provide flexible piping for connection to coil. Piping shall be configured such that unions are hard mounted to coil either directly or with elbows as appropriate to allow straight flexible connection without ninety degree change in direction.

Flexible pipe shall be mounted between coil union and control valve or strainer valve.

2.07 DAMPERS

- A. The BMS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BMS Contractor or as specifically indicated on the drawings.
- B. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.
- C. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
- D. Damper frames and blades shall be constructed of aluminum. Maximum blade length in any section shall be 60". Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Damper widths from 12" to 60" wide shall not leak any greater than 8 CFM sq. ft. @ 4" w.g. and a maximum of 3 CFM sq. ft. @ 1" w.g. static pressure when tested in accordance with AMCA Std. 500.
 - 1. Construction shall be airfoil blade dampers of double skin construction with linkage out of the air stream. This shall be used up to but no more than 4000 FPM or 6" w.g. Acceptable manufacturers are Ruskin CD50 or approved equivalent.
- E. Multiple section dampers may be jack-shafted to allow mounting of piston pneumatic actuators and direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that conditioned power supply is available to control units and operator workstation.
- B. Verify that duct, pipe, and equipment mounted devices and wiring are installed before proceeding with installation.

3.02 INSTALLATION

- A. Install equipment level and plumb.
- B. Install software in control units and operator workstation. Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- C. Connect and configure equipment and software to achieve sequence of operation specified.
- D. Verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Locate all 60 inches above the floor.
 - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- E. Install guards or tamper proof enclosures on thermostats in the following locations:
 - 1. Entrances.
 - 2. Public areas.
 - 3. Where indicated.
- F. Install automatic dampers according to Section 23 32 00 – Sheet Metal Accessories.
- G. Install damper actuators on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- H. Install labels and nameplates to identify control components according to Section 22 05 53 - Mechanical Identification
- I. Install hydronic instrument wells, valves, and other accessories according to Section 23 05 16 – Piping and Fittings.

- J. Install steam and condensate instrument wells, valves, and other accessories according to Section 23 05 16 – Piping and Fittings.
- K. Install duct volume-control dampers according to Section 23 32 00 – Sheet Metal Accessories.
- L. Install electronic and fiber-optic cables according to Division 26.

3.03 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
- B. All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.
- C. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.
- D. Class 2 Wiring
 - 1. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
 - 2. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
 - 3. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduits at the panel terminations. Avoid grounding loops.
- E. BMS Line Voltage Power Source
 - 1. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers. Only the panel boards are provided by Division 26.
 - 2. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.
 - 3. DDC terminal unit controllers may use AC power from motor power circuits.
- F. BMS Raceway
 - 1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit shall be size 1/2".
 - 2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
 - 3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
 - 4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.
- G. Penetrations
 - 1. Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.
 - 2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
 - 3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
 - 4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.
- H. Install signal and communication cable according to Division 26.
 - 1. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 - 2. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.

3. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
- I. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- J. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.04 BMS IDENTIFICATION STANDARDS

- A. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

3.05 BMS PANEL INSTALLATION

- A. Input Devices
 1. All Input devices shall be installed per the manufacturer recommendation
 2. Locate components of the BMS in accessible local control panels wherever possible.

3.06 HVAC INPUT DEVICES – GENERAL

- A. All Input devices shall be installed per the manufacturer recommendation.
- B. Locate components of the BMS in accessible local control panels wherever possible.
- C. The mechanical Contractor shall install all in-line devices such as temperature wells, pressure taps, airflow measuring stations, etc.
- D. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
- E. Outside Air Sensors
 1. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
 2. Sensors shall be installed with a rain proof, perforated cover.
- F. Low Temperature Limit Switches:
 1. Install on the discharge side of the first water or steam coil in the air stream.
 2. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.
 3. For large duct areas, where the sensing element does not provide full coverage of the air stream, provide additional switches to provide full protection of the air stream.
- G. HVAC Output Devices
 1. All output devices shall be installed per the manufacturer's recommendation. The mechanical Contractor shall install all in-line devices such as control valves, dampers, airflow measuring stations, pressure wells, etc.
 2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot petitioners shall be installed to allow for proper sequencing.
 3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
 4. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.
 5. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems.

3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
 - 1. Install piping adjacent to machine to allow service and maintenance.
- B. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.08 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - 1. Leak Test: After installation, fill system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
 - 4. Pressure test control for air piping:
 - a. Pressure test control air piping at 30 psig. or 1.5 times the operating pressure for 24 hours, with maximum 5 psig. loss.
 - b. Pressure test high-pressure control air piping at 150 psig. and low-pressure control air piping at 30 psig. for 2 hours, with maximum 1 psig
 - 5. Calibration and test both pneumatic and electric/electronic thermostats by disconnecting input sensors and stimulating operation with compatible signal generator.
- B. Replace damaged or malfunctioning controls and equipment.
 - 1. Start, test, and adjust control systems.
 - 2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
 - 3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

3.09 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain control systems and components.
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 - 2. Provide operator training on data display, alarm and status descriptors, requesting data, executing commands, calibrating and adjusting devices, resetting default values, and requesting logs.
 - 3. Review data in maintenance manuals. Refer to Division 01- Closeout Procedures
 - 4. Review data in maintenance manuals. Refer to Division 01-Operation and Maintenance Data.
 - 5. Schedule training with Owner, through Owner's Representative, with at least seven (7) days advance notice.

3.10 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

3.11 TRAINING

- A. Provide a minimum of 16 hours of on-site or classroom training throughout the contract period for personnel designated by the Owner. Each session shall be a minimum of two hours in length and must be coordinated with the building Owner. Train the designated staff of Owners Representative and Owner to enable them to:

1. Proficiently operate the system.
2. Understand control system architecture and configuration
3. Understand DDC system components
4. Understand system operation, including DDC system control and optimizing routines (algorithms)
5. Operate the workstation and peripherals
6. Log on and off the system
7. Access graphics, point reports, and logs
8. Adjust and change system set points, time schedules, and holiday schedules
9. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals
10. Understand system drawings, and Operation and Maintenance manual
11. Understand the job layout and location of control components
12. Access data from DDC controllers
13. Operate portable operators terminals

END OF SECTION

**SECTION 23 0920
ADJUSTABLE FREQUENCY DRIVES**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This specification is to cover a complete Adjustable Frequency Motor Drive (AFD), also known as Variable Frequency Drive (VFD), consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor. It is required that the drive manufacturer has an existing:
1. Sales representative exclusively for HVAC products, with expertise in HVAC systems and controls.
 2. An independent service organization.
- B. The drive manufacturer shall supply the drive and all necessary controls as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years.

1.02 QUALITY ASSURANCE

- A. Referenced Standards and Guidelines:
1. Institute of Electrical and Electronic Engineers (IEEE)
 - a. IEEE 519-2014, IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems
 2. Underwriters Laboratories (as appropriate)
 - a. UL 508, 508A, 508C
 - b. UL 61800, 61800-5-1, 61800-5-2
 - c. UL 1995
 3. The Association of Electrical Equipment and Medical Imaging Manufacturers (NEMA)
 - a. NEMA ICS 7-2014, Adjustable Speed Drives
 4. International Electrotechnical Commission (IEC)
 - a. EN/IEC 61800
 5. National Electric Code (NEC)
 - a. NEC 430.120, Adjustable-Speed Drive Systems
 6. CSA Group
 - a. CSA C22.2 No. 274
 7. International Building Code (IBC)
 8. IBC 2018 Seismic – referencing ASCE 7-16 and ICC AC-156
- B. Qualifications:
1. AFDs and options shall be UL listed as a complete assembly. AFD's that require the customer to supply external fuses for the AFD to be UL listed are not acceptable. The base VFD shall be UL listed for 100 kA SCCR when installed in accordance with the manufacturer's guidelines and without the need for input fuses.
 2. CE Mark – The AFD shall conform to the European Union ElectroMagnetic Compatibility directive, a requirement for CE marking. The AFD shall meet product standard EN 61800-3 for the First Environment restricted level.
 3. The base drive shall be seismically certified and labeled as such in accordance with the 2018 International Building Code (IBC):
 - a. Seismic importance factor of 1.5, and minimum 2.5 SDS rating is required.

- b. Ratings shall be based upon actual shake test data as defined by ICC AC-156, via all three axis of motion.
 - c. Seismic certification of equipment and components shall be provided by OSHPD preapproval.
- 4. The base drive shall be SEMI-F47 certified. The drive must tolerate voltage sags to 50% for up to 0.2 seconds, sags to 70% for up to 0.5 seconds, and sags to 80% for up to one second.
- 5. The AFD manufacturer shall have available a comprehensive, HVAC Drive Computer Based Training (CBT) product. The CBT product shall include detailed, interactive sections covering AFD unpacking, proper mechanical and electrical installation, and programming. The CBT product shall allow the user to provide just-in-time training to new personnel or refresher training for maintenance and repair personnel on the user's site. The CBT product shall be repeatable, precise and shall include record keeping capability. The CBT product shall record answers to simulations and tests by student ID. The CBT product must be professionally produced and have interactive sections, student tests, and include video clips of proper wiring and installation.

1.03 SUBMITTALS

- A. Submittals shall include the following information:
 - 1. Outline dimensions, conduit entry locations and weight.
 - 2. Customer connection and power wiring diagrams.
 - 3. OSHPD preapproval, seismic certification and installation requirements where applicable.
 - 4. Complete technical product description with a complete list of options provided. Any portions of this specification not met must be clearly indicated or the supplier and contractor shall be responsible to provide all additional components required to meet this specification.
 - 5. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
 - a. The AFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as required by the AFD manufacturer to ensure compliance with IEEE standard 519. All AFD's shall include a minimum of 5% impedance reactors, no exceptions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers
 - 1. ABB, ACH580 Series (Basis of Design)
 - 2. Yaskawa, U1000 Series
 - 3. Or prior approved equivalent.

2.02 ADJUSTABLE FREQUENCY DRIVES

- A. General: The AFD package as specified herein shall be enclosed in a NEMA and UL Listed Type enclosure, completely assembled and tested by the manufacturer to comply with ISO9001 standards.
- B. The drive shall provide full rated output from a line of +10% to -15% of nominal voltage. The drive shall continue to operate without faulting from a line of +25% to -35% of nominal voltage.
 - 1. Drives shall be capable of continuous full load operation under the following environmental operating conditions:
 - a. Ambient temperature -15 to 40° C (5 to 104° F).
 - b. Altitude 0 to 1000 m (0 to 3,300 ft) above sea level.

- c. Humidity 5 to 95%, non-condensing.
- 2. Provide dV/dT output filters to all variable frequency drives which require a wiring length in excess of 100 feet to serve electric motors located downstream of the AFD. Contractor shall coordinate with the AFD manufacturer for proper selection, compatibility and installation of AFD's, output filters and motors.
- C. All AFDs shall have the following standard features:
 - 1. AFDs for motors shall be ultra-low harmonic (ULH) drives designed with built-in harmonic avoidance systems and shall meet low harmonic limit recommendations from IEEE519 and G5/5. ULH drives shall keep the current harmonics in undistorted networks below 3% under all load conditions.
 - 2. All AFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple AFDs.
 - 3. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.
 - 4. There shall be a built-in time clock in the AFD keypad. The clock shall have a battery back-up with 5-year minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the AFD shall automatically revert to hours of operation since initial power up. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. The AFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.
 - 5. The AFD's shall utilize pre-programmed application macro's specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The AFD shall have two user macros to allow the end-user to create and save custom settings.
 - 6. The AFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the AFD from the wall or removal of circuit boards. The AFD cooling fans shall operate only when required. To extend the fan and bearing operating life, operating temperature will be monitored and used to cycle the fans on and off as required.
 - 7. The AFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set-point without safety tripping or component damage (flying start).
 - 8. The AFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
 - 9. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-pole motors.
 - 10. The AFD shall have an integral 5% impedance line reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. AFD's with only one DC reactor shall add AC line reactors.

11. The input current rating of the AFD shall be no more than 3% greater than the output current rating. AFD's with higher input current ratings require the upstream wiring, protection devices and source transformers to be oversized per NEC 430-2.
12. The AFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.
13. The AFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.
14. If the input reference (4-20mA or 2-10V) is lost, the AFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the AFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.
15. The AFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.
16. The AFD shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.

D. All AFDs to have the following adjustments:

1. Three (3) programmable critical frequency lockout ranges to prevent the AFD from operating the load continuously at an unstable speed.
2. Two (2) PID set-point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the AFD, using the microprocessor in the AFD for the closed loop control. The AFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID set-point shall be adjustable from the AFD keypad, analog inputs, or over the communications bus. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter set-points, etc. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain set-point of an independent process (ie. valves, dampers, etc.). All set-points, process variables, etc. to be accessible from the serial communication network. The set-points shall be set in Engineering units and not require a percentage of the transducer input.
3. Two (2) programmable analog inputs shall accept current or voltage signals.
4. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.
5. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices, typically programmed as follows:
 - a. There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications) the AFD shall provide a dry contact closure that will signal the damper to open (AFD motor does not operate). When the

damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to an AFD digital input and allows AFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety status shall also be transmitted over the serial communications bus. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.

6. Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. Default settings shall be for run, not faulted (fail safe), and run permissive. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs shall be true form C type contacts; open collector outputs are not acceptable.
 7. Seven (7) programmable preset speeds.
 8. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.
 9. The AFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.
 10. The AFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual AFD temperature that allows the highest carrier frequency without derating the AFD or operating at high carrier frequency only at low speeds.
 11. The AFD shall include password protection against parameter changes.
- E. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). The keypad shall utilize the following assistants:
1. Start-up assistants.
 2. Parameter assistants
 3. Maintenance assistant
 4. Troubleshooting assistant
- F. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):
1. Output Frequency
 2. Motor Speed (RPM, %, or Engineering units)
 3. Motor Current
 4. Calculated Motor Torque
 5. Calculated Motor Power (kW)
 6. DC Bus Voltage
 7. Output Voltage
- G. The AFD shall include a fireman's override input. Upon receipt of a contact closure from the fireman's control station, the AFD shall operate at an adjustable preset speed. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands) and force the motor to run at the adjustable, preset speed. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the AFD shall resume normal operation.
- H. Security Features

1. The drive manufacture shall clearly define cybersecurity capabilities for their products.
 2. The drive shall include password protection against parameter changes.
 - a. There shall be multiple levels of password protection including: End User, Service, Advanced, and Override.
 - b. The drive shall support a customer generated unique password between 0 and 99,999,999.
 - c. The drive shall log an event whenever the drive password has been entered.
 - d. The drive shall provide a security selection that prevents any “back door” entry. This selection even prevents the drive manufacturer from being able to bypass the security of that drive.
 - e. A security level shall be available that prevents the drive from being flashed with new firmware.
 3. A checksum feature shall be used to notify the owner of unauthorized parameter changes made to the drive. The checksum feature includes two unique values assigned to a specific programming configuration.
 - a. One checksum value shall represent all user editable parameters in the drive except communication setup parameters. A second checksum value shall represent all user editable parameters except communication setup, energy, and motor data parameters.
 - b. Once the drive has been commissioned the two values can be independently saved in the drive.
 - c. The drive shall be configurable to either: Log an Event, provide a Warning, or Fault upon a parameter change when the current checksum value does not equal the saved checksum value.
 4. The “Hand” and “Off” control panel buttons shall have the option to be individually disabled (via parameter) for drives mounted in public areas.
 5. The capability to disable Bluetooth on control panels that include Bluetooth functionality shall be provided.
- I. Serial Communications:
1. The drive shall have an EIA-485 port with removable terminal blocks. The onboard protocols shall be BACnet MS/TP, Modbus, and Johnson Controls N2. Optional communication cards for BACnet/IP, LonWorks, Profibus, Profinet, EtherNet/IP, Modbus TCP, and DeviceNet shall be available. The use of third party gateways and multiplexers is not acceptable. All protocols shall be “certified” by the governing authority. Use of non-certified protocols is not allowed. Coordinate required communications protocol with Controls Contractor.
 2. The drive shall have the ability to communicate via two protocols at the same time, one onboard protocol and one option card based protocol. Once installed, the drive shall automatically recognize any optional communication cards without the need for additional programming.
 3. The drive shall not require a power cycle after communication parameters have been updated.
 4. The embedded BACnet connection shall be a MS/TP interface. The drive shall be BTL Listed to Revision 14 or later. Use of non-BTL Listed drives are not acceptable.
 5. The drive shall be classified as an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
 - a. Data Sharing: Read Property Multiple-B, Write Property Multiple-B, COV-B
 - b. Device Management: Time Synchronization-B

- c. Object Type Support: MSV, Loop
- 6. The drive's relay output status, digital input status, analog input/output values, Hand-Auto status, warning and fault information shall be capable of being monitored over the network. The drive's start/stop command, speed reference command, relay outputs and analog outputs shall be capable of being controlled over the network. Remote drive fault reset shall be possible.
- J. If additional hardware is required to obtain the BACnet interface, the AFD manufacturer shall supply one BACnet gateway per drive. Multiple AFDs sharing one gateway shall not be acceptable.
 - 1. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the AFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote AFD fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus – keypad "Hand" or "Auto" selected, bypass selected, the ability to change the PID setpoint, and the ability to force the unit to bypass (if bypass is specified). The DDC system shall also be able to monitor if the motor is running in the AFD mode or bypass mode (if bypass is specified) over serial communications. A minimum of 15 field parameters shall be capable of being monitored.
 - 2. The AFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. This control shall be independent of any AFD function. For example, the analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive's digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive's digital and analog inputs shall be capable of being monitored by the DDC system.
 - 3. The AFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass valve control, chilled water valve control, etc. Both the AFD control PID loop and the independent PID loop shall continue functioning even if the serial communications connection is lost. The AFD shall keep the last good set-point command and last good DO & AO commands in memory in the event the serial communications connection is lost.
- K. EMI / RFI filters. All AFD's shall include EMI/RFI filters. The onboard filters shall allow the AFD assemble to be CE Marked and the AFD shall meet product standard EN 61800-3 for the First Environment restricted level.
- L. All AFD's through 50HP shall be protected from input and output power mis-wiring. The AFD shall sense this condition and display an alarm on the keypad.
- M. Disconnect – A circuit breaker shall be provided when indicated on the drive schedule. Drive input fusing shall be included on all packaged units that include a disconnecting means. All disconnect configurations shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. Disconnect packages manufactured by anyone other than the drive manufacturer, are not acceptable.
- N. Bypass – Bypass drive packages shall be provided when indicated on the drive schedule. All drive/bypass configurations shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. Bypasses manufactured by anyone other than the drive manufacturer, are not acceptable.

1. The drive and bypass package shall be a complete factory wired and tested bypass system consisting of a padlockable disconnect device, drive output contactor, bypass contactor, and drive input fuses.
2. The drive and bypass package shall have a UL listed short circuit current rating of 100 kA, for 240 VAC and 480 VAC systems, and this rating shall be indicated on the rating label.
3. The bypass control shall be powered by a three-phase switch mode power supply with a voltage tolerance of +30%, -35%. Single-phase power supplies and control power transformers (CPT) are not acceptable.
4. The drive and bypass package shall be seismic certified and labeled to the IBC. Seismic importance factor of 1.5 rating is required, and shall be based upon actual shake table test data as defined by ICC AC-156. Seismic certification of equipment and components shall be provided by OSHPD preapproval.
5. All bypass packages shall utilize a dedicated LCD bypass control panel (keypad) user interface. The bypass control panel must be a separate display from the drive control panel. Bypass packages that use a single shared drive/bypass control panel are not acceptable, due to that control panel acting as a single point of failure.
 - a. The bypass shall include a two-line, 20-character LCD display. The display shall allow the user to access parameters and view:
 - 1) Bypass input voltage, current (Amps) and power (kW)
 - 2) Bypass faults, warnings, and fault logs
 - 3) Bypass operating time and energy consumption (resettable)
 - b. The bypass control panel shall include the following controls:
 - 1) Four navigation keys (Up, Down, Enter, Escape)
 - 2) Bypass Hand-Off-Auto, Drive mode / Bypass mode selectors, Bypass fault reset
 - c. The following indicating lights (LED PTT type) or control panel display indications shall be provided.
 - 1) Drive mode selected, Bypass mode selected
 - 2) Drive running, Bypass running
 - 3) Drive fault, Bypass fault
 - d. Safety interlock and run permissive status shall be displayed using predetermined application specific nomenclature, such as: Damper end switch, smoke alarm, vibration trip, and overpressure.
6. All bypasses shall have the following hardware features/characteristics as standard:
 - a. Six (6) digital inputs and five (5) Form-C relay outputs. The digital inputs shall be capable of accepting both 24 VDC and 24 VAC. The bypass control board shall include an auxiliary power supply rated 24 VDC, 250 mA.
 - b. Drive isolation fuses shall be provided. Bypass designs which have no such fuses, or that only incorporate fuses common to both the drive and the bypass are not acceptable. Third contactor "isolation contactors" and service switches are not an acceptable alternative to drive isolation fuses.
 - c. The bypass shall be able to detect a single-phase input power condition while running in bypass, disengage the motor, and provide a single-phase input power indication.
 - d. The bypass shall be designed for stand-alone operation and be completely functional in both Hand and Automatic modes, even if the drive and/or drive's control board has failed. Network communications shall remain functional.

Bypass systems that do not maintain full functionality in the event of a drive failure, are not acceptable.

7. All bypasses shall have the following software features as standard:
 - a. Programmable loss-of-load (broken belt / coupling) indication shall be functional in drive and bypass mode.
 - b. The bypass shall also support run permissive and start interlock control functionality, including start delay, as previously specified in the drive section.
 - c. The bypass control shall monitor the status of the drive and bypass contactors and indicate when there is a welded contactor contact or open contactor coil.
 - d. The bypass shall include a selection for either manual or automatic transfer to bypass. The automatic transfer mode shall allow the user to select the specific drive fault types that result in an automatic transfer to bypass. The automatic transfer mode shall not allow a transfer to bypass on motor related faults. Automatic transfer schemes that do not differentiate between fault types, are not acceptable.
 - e. The bypass shall include the ability to select the operating mode of the system (Drive/Bypass) from either the bypass control panel or digital input.
 - f. The bypass shall include a supervisory control mode that monitors the value of the drive's analog input (feedback). This feedback value is used to control the bypass contactor on/off state. The supervisory mode shall allow the user to maintain hysteresis control over applications such as cooling towers and booster pumps.
 - g. Selectable Class 10, 20, or 30 electronic motor overload protection shall be included in both drive and bypass mode.
 - h. The drive and bypass shall be designed to operate as an integrated system when in Override mode. Whether operating in drive or bypass mode, the low priority safeties will be ignored, and high priority safeties will be followed. External start/stop commands will be ignored. There shall be four selectable Override modes:
 - 1) Bypass only, with two smoke control modes:
 - a) Fixed pre-configuration of digital inputs
 - b) Configurable high/low priority safeties and faults, to allow configuration to meet needs of local Authority Having Jurisdiction.
 - 2) Drive only
 - 3) Drive then transfer to bypass, in the event of a drive fault
 - 4) Force to Stop
8. Network communications – the bypass shall include BACnet MS/TP, Modbus, and Johnson Controls N2 as standard. The bypass BACnet implementation shall be BTL Listed to Revision 14 or later. Optional communication cards for BACnet/IP, LonWorks, Profibus, Profinet, Ethernet/IP, Modbus TCP, and DeviceNet shall be available.
 - a. The bypass relay output status, digital input status, warning and fault information can be monitored over the network. Status information shall be monitored, including; operating mode (drive vs bypass), current drawn in bypass mode, broken belt, and phase-to-phase voltage. The bypass start/stop command, force to bypass command, and relay outputs shall be capable of being controlled over the network.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.
- B. Power wiring shall be completed by the electrical contractor. The contractor shall complete all wiring in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.
- C. AFD Data: Provide neatly typed label, as specified elsewhere, on each variable frequency drive enclosure identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.
- D. The AFD shall be located as shown on the drawings. The AFD shall be wall mounted or furnished with steel freestanding panels, as appropriate to the location and as specified.
- E. Freestanding panels shall be securely anchored to the floor with steel bolts, the number and size of which shall be consistent with the size and weight of the enclosure.
- F. Wall mounted panels shall be secured to structural walls with steel bolts, the number and size of which shall be consistent with the size and weight of the enclosure.
- G. Installations shall meet the applicable requirements for seismic restraints as required by codes and standards.
- H. For retrofit applications, remove the existing motor starter, and install the AFD between the existing circuit breaker and the motor disconnect switch, where existing, so that the motor disconnect switch can still be used to isolate the motor. Refer to Division 26.
- I. AFD power output wiring shall not be installed in conduit with wiring for the AFD input wiring or other load. If existing wiring is in conduit with other wiring, then Contractor shall locate AFD appropriately and install new conduit and wiring for the AFD output to the motor. Refer to Division 26.
- J. AFD power and signal wiring shall be installed in appropriate metallic electrical conduit and raceways, which shall be suitably grounded for AFD installations and the AFD manufacturer's recommendations. Refer to Division 26.
- K. Prior to routing and installing any conduit or wiring to the AFD, the Contractor shall verify that the working clearance in front of the AFD enclosure extends out a minimum of 30 inches or as recommended by the AFD equipment manufacturer, whichever is greater. Enclosures shall be located so as to provide ready access to controls and displays, and to allow full, unimpeded opening of doors and covers. AFD shall not intrude on code-required access to, or clearances of, other electrical equipment.

3.02 START-UP

- A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

3.03 PRODUCT SUPPORT

- A. Factory trained application engineering and service personnel that are thoroughly familiar with the AFD products offered shall be locally available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free line.
- B. A computer based training CD or an 8-hour professionally generated digital video (DVD format) shall be provided to the owner at the time of project closeout. The training shall include installation, programming and operation of the AFD, bypass and serial communication.

3.04 WARRANTY

- A. Warranty shall be 60 months (5 years) from the date of substantial completion. The warranty shall include all parts, labor, travel time and expenses. There shall be 24/7/365 support available via a toll-free phone number.

END OF SECTION

SECTION 23 2124
VERTICAL IN-LINE CENTRIFUGAL PUMPS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Requirements of Division 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.
- B. Furnish and install vertical in-line pumps in accordance with these specifications and drawings. The pumps shall be manufactured by a company regularly engaged in the manufacturing and assembly of similar units for a minimum of five (5) years in the United States.

1.02 DESCRIPTION

- A. The Contractor shall furnish materials, equipment and labor to furnish, install and test the pumping system complete with the pumps, motors, mounting bases, piping, valves and appurtenances, as indicated on the contract drawings and as therein specified.
- B. Certain items in this Specification are listed by manufacturer and/or manufacturer's model number to establish general style, type, character and quality of the product desired. Similar items manufactured by other than those listed will be considered, providing submittals are made according to Article 4 of Instructions to Bidders.

1.03 INSTALLATION

- A. The Contractor shall insure that the pumps and motors are properly installed with no pipe strain transmitted to the pump casing.

1.04 RESPONSIBILITY

- A. To assure a properly integrated and compatible system, all equipment described in this section shall be furnished by the equipment manufacturer, who shall assume full responsibility for the proper operation of the pumps and associated equipment.

1.05 REFERENCE STANDARDS

- A. The work in this section is subject to the requirements of applicable portions of the following standards:
 - 1. Hydraulic Institute Standards
 - 2. IEEE Standards
 - 3. NEMA Standards
 - 4. OSHA Rules and Regulations

1.06 TESTING & APPROVING AGENCIES

- A. Where items of equipment are required to be provided with compliance to U.L., A.G.A., or other testing and approving agencies, the contractor may submit a written certification from any nationally recognized testing agency, adequately equipped and competent to perform such services, that the item of equipment has been tested and conforms to the same method of test as the listed agency would conduct.

1.07 SUBMITTAL DATA

- A. Provide manufacturer's literature for all products specified in this Section, which will be installed under this project.
- B. Provide performance curves for all pumps. Plot the specified operating point for each pump on its respective curve. Pumps shall be sized and selected for parallel pumping applications.
- C. Provide complete literature for all components of packaged systems. These include pump performance, heat exchanger calculations, expansion tank capacity, data for all accessories and valves and complete wiring diagrams specific to the exact unit to be supplied. The wiring diagram shall indicate all required field and factory wiring.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Pump manufacturer shall be Armstrong, Taco, ITT Bell & Gossett, Grundfos or prior approved equivalent. The capacities and characteristics shall be as called for in the plans/schedules.

2.02 GENERAL DESCRIPTION

- A. Furnish and install single stage pump(s) with capacities and characteristics as shown on the equipment schedules. Unless otherwise noted, the pump(s) shall be split coupled, vertical in-line centrifugal type.

2.03 MATERIALS OF CONSTRUCTION

Casing.....Cast Iron (ASTM A48)
Impeller.....Bronze (ASTM B584)
Shaft.....Stainless Steel
Case Wear Ring.....Bronze (ASTM B62)
Shaft Sleeve.....Bronze (ASTM B62)

2.04 CASING

- A. Pump casing shall be constructed of ASTM A48 class 30 cast iron. The pump casing/volute pressure rating shall exceed the shut-off (dead-head) pressure of the pump. The pump flanges shall be matched to suit the pressure of the pump casing/volute and the piping components on the job, with either ANSI Class 125 flanges or ANSI class 250 flanges. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line. The pump cover shall be drilled and tapped to accommodate a seal flush line which can be connected to the corresponding tapping on the discharge connection, or to an external source to facilitate cooling and flushing of the seal faces.
- B. All casings shall be flanged. Threaded casings not allowed unless extra unions and fittings are provided with that pump to allow servicing.

2.05 IMPELLER

- A. The impeller shall be ASTM B584-836/875 bronze and hydraulically balanced. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. The impeller shall be cast by the hydraulically efficient lost foam technique to ensure repeatability of high quality.

2.06 SHAFT

- A. The pump shall be manufactured with AISI 416 Stainless Steel shaft. The pump and motor shaft must be connected with circular keys capable of transmitting axial loads to motor bearings.

2.07 SEAL

- A. The pump shall be fitted with a single mechanical seal, with EPT elastomers and Carbon/Ceramic faces, rated up to 250°F. The pump shall have a factory installed vent/flush line to insure removal of trapped air and mechanical seal cooling. The vent/flush line shall run from the seal chamber to the pump discharge. Extended seal life can be accomplished with an optional filter or sediment separator, which can be incorporated in the vent/flush line.
- B. In order to both simplify and reduce the total cost of ownership, the manufacturer shall standardize on no more than three sizes of mechanical seals throughout the entire range of the family of pumps. The manufacturer shall not use multiple part numbers for the same part.

2.08 SHAFT COUPLING

- A. The pump shall be coupled via a high tensile aluminum split style coupling. The design must permit easy replacement of the mechanical shaft seal without disturbing the pump, motor or electrical wiring. The motor mount must be designed to accept several different motor frame standards; CZ and HP. Couplings shall be protected by a guard. The use of adhesive compounds to fasten the sleeve to the shaft shall not be accepted.

2.09 MOTOR

- A. Each motor shall have a sufficient horsepower rating to operate the pump at any point on the pump's head-capacity curve without overloading the nameplate horsepower rating of the motor, regardless of service factor. The motor shall have a service factor of at least 1.15. The service factor is reserved for variations in voltage and frequency. Each pump and pump motor shall meet or exceed the requirement of ASHRAE/IESNA Standard 90.1-2010. The pump shall be coupled to a NEMA rated motor (premium efficiency) designed for continuous operation and readily removable for servicing. All motors located outside shall be TEFC unless otherwise noted. Motors shall be inverter duty rated to accept adjustable frequency drives. Refer to Section 23 05 13 - Motors for additional requirements.

PART 3 - EXECUTION

3.01 GENERAL

- A. Pump inlet shall be fitted with a multifunction inlet suction diffuser fitting. The suction diffuser guide body and cover plate shall be ductile iron and be rated for the pressure rating of the pump volute/casing. The suction diffuser guide flanges shall be matched to suit the working pressure of the pump casing/volute and piping components on the job; with either ANSI class 125 flanges or ANSI class 250 flanges. The suction guide shall include the following components; full length stainless steel straightening vanes, permanent stainless steel strainer, disposable 16 mesh bronze start-up strainer, blow down ports, and metering ports. For those pumps where an inlet guide fitting is not installed, there shall be a minimum of five pipe diameters of straight, undisturbed flow going into the pump suction.
- B. Contractor shall install pump in accordance with the manufacturer's installation instructions and recommendations.
- C. Contractor shall level each pump.
- D. Pipe connections to pumps shall be made in such a manner so as not to exert any stress on the pump housing. Provide additional pipe supports as necessary to meet this requirement.

3.02 START-UP

- A. The pumps shall be tested at start-up by a representative approved by the manufacturer. A start-up report, as provided by the manufacturer, shall be completed before final acceptance of the pumps.
- B. Pumps shall not be run dry to check rotation.
- C. Change start-up strainers to permanent strainer upon acceptance of the job. Provide a blow-down valve on each strainer and terminate with hose thread or extend blow-down line to nearest floor drain.

3.03 INSTALLATION AND ACCEPTANCE TESTS

- A. The pumping units shall be installed in accordance with the instructions of the manufacturer and/or as shown on the drawings by the Contractor.
- B. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.
- C. Contractor shall furnish a concrete inertia base for pumps that are to be supported from the floor. Inertia base weight shall be 2 ½ times the weight of the pump and the pump motor. Pump supports to be rigidly fastened to concrete inertial base per manufacturer's recommendations.

END OF SECTION

**SECTION 23 3100
SHEET METAL DUCT**

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes metal, rectangular ducts and fittings for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus (-) 2.0 to plus (+) 10.0 inches w.g. Metal ducts include the following:
 - 1. Rectangular ducts and fittings.
 - 2. Double-wall, round, and flat-oval spiral-seam ducts and formed fittings.
 - 3. Duct liner.
- B. See Section 23 32 00 - Sheet Metal Accessories for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
- C. See Section 23 07 00 for insulation requirements.
- D. Pittsburgh seams shall be the only acceptable seam type. Button punch is not acceptable.

1.02 SUBMITTALS

- A. Submit under provisions of Section 01 33 23.
- B. Shop Drawings: Show fabrication and installation details for metal ducts including, but not limited to:
 - 1. Penetrations through fire-rated and other partitions.
 - 2. Duct layout indicating sizes and pressure classes.
 - 3. Elevations of top and bottom of ducts
 - 4. Dimensions of main duct runs from building grid lines
 - 5. Seam and joint construction
 - 6. Duct accessories, including access doors and panels.
 - 7. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.
- C. Provide catalog cuts of materials and fittings, and indicate ductwork construction features such as gages, sizes, welds, and configuration.
- D. Record Drawings: At project closeout, submit record drawings of installed systems to Architect.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Store ducts and fittings inside weather-tight trailers or weather-tight buildings.
- B. Protect ductwork shall from water, dirt, chemical, and mechanical damage.
- C. Deliver all ductwork and fittings to the site clean of any foreign materials and provide protective covers on all openings in the duct and fittings.
 - 1. Remove protective covers during installation.
 - 2. Provide protective covers at all openings at the completion of the phase of work at the end of each workday.

1.04 DEFINITIONS

- A. Low Pressure Duct: Duct required by the drawings, specifications, or referenced standards to be constructed to 2" or less, positive or negative pressure class.
- B. Medium or High Pressure Duct: Duct required by the drawings, specifications, or referenced standards to be constructed to greater than 2" positive or negative pressure class.

1.05 QUALITY ASSURANCE

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

- B. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years.
- C. Installer's Qualifications: Firm with at least 10 years of successful installation experience on projects with metal ductwork systems like that required for this project.
- D. NFPA Compliance:
 - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts that are exposed to view shall have mill-phosphatized finish for enhanced paint adhesion and corrosion resistance.
- C. Stainless Sheet Steel: Lock-forming quality; complying with ASTM A 167/A 480 and having No. 2d finish- cold-rolled, dull finish; ducts shall have a No. 4 finish for surfaces exposed to view.
- D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 SEALANT MATERIALS

- A. Joint and Seam Tape: 2 inches wide; glass-fiber-reinforced fabric.
- B. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
- C. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
- D. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
- E. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- F. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.04 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Galvanized-steel shapes and plates complying with ASTM A 36/A 36M.

2.05 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
 1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Ward Industries, Inc.
 2. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.
- C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
 1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Lockformer.
 - c. TDF/TDC
 2. Longitudinal Seams: Pittsburgh lock sealed with non-curing polymer sealant.
- D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of non-braced panel area unless ducts are lined.

2.06 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

- A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.
- B. Round, Longitudinal and Spiral Lock Seam Ducts: Unless otherwise noted, fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals. Use the following metal thickness for pressure classes from minus (-) 2 to plus (+) 10-inch w.g.:
 1. Ducts 3 to 16 Inches in Diameter: 24 ga.
 2. Ducts 17 to 48 Inches in Diameter: 22 ga.
 3. Ducts 49 to 84 Inches in Diameter: 20 ga.

- C. Flat-Oval, Longitudinal and Spiral Lock Seam Ducts: Unless otherwise noted, fabricate ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals. Fabricate ducts larger than 72 inches in diameter with butt-welded longitudinal seams. Use the following metal thickness for pressure classes from minus (-) 2 to plus (+) 10-inch w.g.:
1. Ducts 3 to 16 Inches in Diameter: 24 ga.
 2. Ducts 17 to 48 Inches in Diameter: 22 ga.
 3. Ducts 49 to 84 Inches in Diameter: 20 ga.
- D. Manufacturers:
1. Linx Industries, Inc.
 2. McGill AirFlow Corporation
 3. SEMCO Incorporated
 4. Spiral Pipe of Texas
- E. Duct Joints:
1. Ducts up to 20 inches in diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
 2. Ducts 21 to 72 inches in diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
 3. Ducts larger than 72 inches in diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
 4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
 - a. Manufacturers:
 - 1) Linx Industries, Inc.
 - 2) Ductmate Industries, Inc.
 - 3) WARD Industries
 5. Flat-Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.
 - a. Manufacturers:
 - 1) Linx Industries, Inc.
 - 2) Ductmate Industries, Inc.
 - 3) SEMCO Incorporated.
 - 4) WARD Industries
- F. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
- G. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- H. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1.5 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus (-) 2 to plus (+) 10-inch w.g.:
 - a. Ducts 3 to 16 Inches in Diameter: 24 ga.
 - b. Ducts 17 to 48 Inches in Diameter: 22 ga.

- c. Ducts 49 to 84 Inches in Diameter: 20ga.
- 3. Flat-Oval Mitered elbows: Welded construction with same metal thickness as longitudinal-seam flat-oval duct.
- 4. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
- 5. Round elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
- 6. Round elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
- 7. Round elbows larger than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
- 8. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch (20ga.) thick with 2-piece welded construction.
- 9. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
- 10. Flat-Oval Elbow Metal Thickness: Same as longitudinal-seam flat-oval duct specified above.

2.07 DOUBLE-WALL DUCT AND FITTING FABRICATION

- A. Manufacturers:
 - 1. Linx Industries, Inc.
 - 2. McGill AirFlow Corporation.
 - 3. SEMCO Incorporated.
 - 4. Sheet Metal Connectors, Inc.
 - 5. Or prior approved equivalent.
- B. Ducts: Fabricate double-wall (insulated) ducts with an outer shell and an inner duct. Dimensions indicated are for inner ducts.
 - 1. Outer Shell: Base metal thickness on outer-shell dimensions. Fabricate outer-shell lengths 2 inches longer than inner duct and insulation and in metal thickness specified for single-wall duct.
 - 2. Insulation: Thermal Conductivity (Max.): 0.27 Btu-in/ft²-hr-°F. (per ASTM C 177)
 - 3. Solid Inner Ducts: Use the following sheet metal thicknesses and seam construction:
 - a. Ducts 3 to 16 Inches in Diameter: 24 ga. with standard spiral-seam construction.
 - b. Ducts 17 to 48 Inches in Diameter: 22 ga. with single-rib spiral-seam construction.
 - c. Ducts 49 to 84 Inches in Diameter: 20 ga. with single-rib spiral-seam construction.
 - 4. Maintain concentricity of inner duct to outer shell by mechanical means. Prevent dislocation of insulation by mechanical means.
- C. Fittings for pressure classes from minus (-) 2 to plus (+) 10-inch w.g.: Fabricate double-wall (insulated) fittings with an outer shell and an inner duct.
 - 1. Solid Inner Ducts: Use the following sheet metal thicknesses:
 - a. Ducts 3 to 16 Inches in Diameter: 24 ga.
 - b. Ducts 17 to 48 Inches in Diameter: 22 ga.
 - c. Ducts 49 to 84 Inches in Diameter: 20 ga.

PART 3 - EXECUTION

3.01 DUCT APPLICATIONS

- A. With the exception of ductwork located inside of mechanical rooms, provide double-wall duct and fittings for all interior ductwork exposed to view.

B. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. All Supply and Return Air Ducts: (+) 3-inch w.g.
2. Outside Air Ducts (Negative Pressure): (-) 3-inch w.g.
3. General Exhaust Ducts (Negative Pressure): (-) 3-inch w.g.
4. Laboratory/Hazardous Exhaust Ducts (Negative Pressure): (-) 4-inch w.g.
5. Combustion Air Ducts: (+) 4-inch w.g.

3.02 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install ducts with fewest possible joints.
- C. Install fabricated fittings for changes in directions, size, and shape and for connections.
- D. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of e , with a minimum of 3 screws in each coupling.
- E. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- I. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- J. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- K. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- L. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
- M. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Section 23 32 00 - Sheet Metal Accessories. Firestopping materials and installation methods are specified in Division 07 - Penetration Firestopping.
- N. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

3.03 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
 1. Seal all ductwork transverse joints and seams to Seal Class A.
 2. Seal air tight all ductwork connections to air distribution devices including, but not limited to, grilles, diffusers, registers, louvers, dampers, etc.
- B. Seal ducts before external insulation is applied.

3.04 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

- B. Support vertical ducts at maximum intervals of 10 feet and at each floor.
- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- D. Install concrete inserts before placing concrete.
- E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

3.05 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Section 23 32 00 - Sheet Metal Accessories.
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 FIELD QUALITY CONTROL:

- A. Leakage Tests: Conduct duct leakage test in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Repair leaks and repeat tests until total leakage is less than 3% unless otherwise noted. For hazardous exhaust ductwork, repair leaks and repeat tests until total leakage is less than 0.01%.
- B. General:
 - 1. Ductwork pressure tests shall be observed by Architect prior to installation of insulation.
 - 2. Ductwork systems constructed to 3" W.G. pressure class and higher shall be tested in their entirety for leaks.
 - 3. All new and existing supply and exhaust ductwork, excluding ductwork located within shafts, shall be leak tested. If test pressure and leakage requirements are not met, repairs and sealing shall be done with sheet metal, tape, sealant or a combination thereof. Testing shall include removal and replacement of existing duct insulation as necessary.
 - 4. Test Failures: Duct systems shall be repaired if test pressure and leakage requirements are not met or if air noise condition is encountered. Repairs and sealing shall be done with sheet metal, tape, sealant, or a combination thereof.
- C. Test Equipment:
 - 1. Portable rotary type blower or tank type vacuum cleaner with control damper. Equipment shall have sufficient capacity to properly test reasonably large duct system section.
 - 2. Orifice assembly consisting of straightening vanes and calibrated orifice plate mounted in a straight tube with properly located pressure taps.
 - 3. Two (2) U-tube manometers, one to measure drop across calibrated orifice and one to measure S.P. in duct being tested. Provide low differential pressure Dwyer magnehelic gauges for low leak testing in lieu of U-tube manometers.
- D. Testing Pressures and Permissible Leakage:
 - 1. Test pressure shall be equal to the construction class. Negative pressure duct shall be tested at the equivalent positive pressure.
 - 2. Allowable leakage shall be determined from the following equation (or figure 4-1 in the above referenced Standard):

$$F = CL (P)^{0.65}$$

Where: F = Allowable leakage factor CFM/100 Sq. Ft.
 CL = Leakage Class
 P = Test pressure inches W.C.

3. Leakage class shall be as follows:

DUCT SEAL AND LEAKAGE CLASSES			
	Duct Pressure Classification (Rated Static Pressure)		
	up to 3.0 in. w.g.	higher than 3.0 in. w.g.	All Hazardous Exhaust
Required Seal Class	B	A	A
Required Sealing	Traverse Joints and Seams	Joints, Seams and All Applicable Wall Penetrations	Joints, Seams and All Applicable Wall Penetrations
Required Leakage Class Rectangular Metal	6	4	0
Required Leakage Class Round Metal	4	2	0

4. Record all tests using the procedure and forms in the above referenced manual.
5. All plenums and casings shall be tested to the pressure class indicated and visually observing leakage and panel deflection.
 - a. No noticeable leakage shall be allowed.
 - b. Deflection shall be less than 1/8" per foot.

3.07 INSPECTION:

- A. After completion of the ductwork installation, and after the Test and Balancing work, a minimum of 10% of the installed length of the supply duct system shall be inspected by an independent company specializing in such work. Inspection shall be performed using fiber optic video equipment and other appropriate techniques.
 1. Sections to be inspected shall be determined by the Architect.
- B. A report, including a recording on electronic format of the video shall be submitted to the Architect. The report shall document the findings of the inspection, listing any areas of concern, including evidence of water, dust, dirt, and construction debris.
- C. If, in the opinion of the Architect and the Inspection company, the supply ductwork is unacceptably contaminated, the supply duct system shall be cleaned. Additional inspections shall be performed, including sections not previously inspected. This process shall be repeated until, in the opinion of the Architect, the supply duct system is acceptably clean.

END OF SECTION

**SECTION 23 3200
SHEET METAL ACCESSORIES**

PART 1 - GENERAL

1.01 PROVISIONS

- A. Requirements of Division 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition.

1.02 DESCRIPTION

- A. Work covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawings.
- B. The work described in this section of the specifications includes but is not limited to the following:
 - 1. Sheet metal accessories as specified herein and in locations shown on drawings, complete with all hardware necessary for a fully functional installation.

1.03 RELATED WORK

- A. The following items of related work are specified and included in other sections of these specifications:
 - 1. Section 22 05 00 - Common Work for HVAC, Plumbing, and Fire Protection
 - 2. Section 23 06 30 - Cleaning Mechanical Systems
 - 3. Section 23 05 94 - Testing, Adjusting & Balancing
 - 4. Section 23 07 00 - Mechanical Systems Insulation
 - 5. Section 23 31 00 - Sheet Metal Duct

1.04 QUALITY ASSURANCE

- A. Fire dampers to be UL labeled and conform to NFPA 90A and NFPA 90B.
- B. Air diffusers, grilles, and registers to have ratings certified by Air Diffusion Council and tested per ADC Equipment Test Code 1062R2 and ASHRAE Standard 36B-63.

1.05 SUBMITTALS

- A. Submit product data to Architect for approval as required by Division 01 for all items listed in this section of the specification.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Grilles, Registers and Diffusers: Titus, Nailor, Price, Krueger or prior approved equivalent.
- B. Flexible Connections: Duro-Dyne, Ventfabrics, or prior approved equivalent.
- C. Manual Dampers: Nailor, Penn, Ruskin, Metal-Form Mfg., Greenheck, Pottorff, United Enertech or prior approved equivalent.
- D. Motorized Control Dampers: Nailor, Penn, Ruskin, Metal-Form Mfg., Greenheck, Pottorff, United Enertech or prior approved equivalent.
- E. Access Doors and Panels: Duro-Dyne, Ruskin, Milcor, Ventfabrics, Pottorff or prior approved equivalent.
- F. Latches, Hinges: Duro-Dyne, Ventfabrics, or prior approved equivalent.

- G. Fire Dampers: Ruskin, Nailor, Pottorff, Greenheck, United Enertech or prior approved equivalent.
- H. Turning Vanes: United Sheet Metal, Duro-Dyne, Elgin, Aero Dyne, or prior approved equivalent.

2.02 ACCESS DOORS

- A. Provide insulated doors in ductwork for equipment service such as automatic dampers, duct coils (each side) casing mounted coils (each side), filters (each side), duct mounted smoke detectors and elsewhere as noted on drawings.
- B. The size of all access doors shall be as follows:

Duct Size	Access Door
12" to 20"	12" x 12"
20" to 36"	18" x 18"
36" and above	24" x 24"
Under 12"	Of sufficient size to service equipment or replace fusible link.
- C. Apparatus Casing Access Doors: Pre-hung door frame assemblies.
- D. Access Doors, Insulated Ducts: Double thickness galvanized sheet metal of same gauge as duct (minimum 20 gauge) with minimum of 1" thick, 2-pound density fiberglass or approved equal insulation in between sheet metal, rolled edges, hinges and latch. Make airtight with felt strips or neoprene gasketing, and provide 1" x 1" galvanized angle iron frame for installation in ductwork.
- E. Mount doors in a rigid frame of at least 22 gauge formed galvanized steel or aluminum.
- F. Use angle iron bracing as required to make the door frame a rigid assembly.
- G. Hinge access doors and provide positive closing, tight sealing and easily operated latches.
- H. Provide latches that permit easy removal of access door while maintaining positive closing and minimum leakage.
- I. Provide sponge rubber gaskets for all doors.
- J. Complete insulation coverage up to the boxes.

2.03 FLEXIBLE CONNECTIONS

- A. Twenty-four ounce glass fabric that is flameproof, airtight, ozone resistant, and a minimum of 3" wide with 3" of metal on each side of 3" of fabric using a grip lock seam.

2.04 MANUAL DAMPERS

- A. Minimum of 16 gauge galvanized steel, maximum of 8" blade, opposed blade type, with manual quadrant. Damper rod and quadrant handle shall extend out a minimum of 2" so as not to interfere with or require compression of external duct wrap.

2.05 MOTORIZED CONTROL DAMPERS

- A. AMCA-rated, opposed-blade design; minimum of 0.1084 inch thick, galvanized-steel frames with holes for duct mounting; minimum of 0.0635 inch thick, galvanized-steel damper blades with maximum blade width of 8 inches.
 - 1. Secure blades to 1/2 inch diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
 - 2. Operating Temperature Range: From minus 40 to plus 200 deg F.
 - a. Provide low-leakage, opposed-blade design with replaceable rubber seals. Dampers shall be rated for maximum leakage per adopted ASHRAE 90.1 Standard when tested according to AMCA Standard 500D.

2.06 MANUAL QUADRANTS

- A. On all low pressure dampers in insulated ducts and in un-insulated ducts approved.

2.07 CONCEALED DAMPER OPERATORS

- A. For ductwork above inaccessible ceilings, the contractor shall furnish a remote balancing damper assembly with a visual damper position indication meter manufactured by Young Regulator, United Enertech or prior approved equivalent.
- B. The Remote Damper Assembly shall consist of a commercial quality damper actuated by a DC motor, a plenum rated cable with RJ connectors, termination options to control the damper from a plenum, wall or ceiling, and a hand held remote controller that provides DC voltage to open and close the damper. The cable shall be available in lengths up to 1,000 feet.
- C. Contractor shall coordinate location of wall or ceiling receptacles with the Architect before installation.

2.08 ACCESS PANELS AND ACCESS OPENINGS IN DUCTWORK

- A. Galvanized, sheet steel, 2 gauges heavier than the duct with rolled edges, felt strips or neoprene gaskets and attached to duct with sheet metal screws a maximum of 6" on center.

2.09 FIRE DAMPERS

- A. Furnish and install access panels as hereinbefore described to meet the requirements of the code. All fire dampers must be constructed in accordance with Underwriters' Laboratories and city code requirements. Dampers shall be dynamic type with the damper out of the airstream for 100% free area.

2.10 FIRE / SMOKE DAMPERS

- A. Furnish and install combination Fire/Smoke dampers approved for installation in walls and floors, sized for the openings, rated per UL 555 and UL555S, leakage Class 1, 1 ½ hour fire rating for closure at 2000 fpm, maximum pressure 6"w.g., 120 volt actuators, normally closed position - powered actuator to open. The dampers and accessories must be approved for the installation and application and the installation must comply with the UL installation requirements for that model damper. The damper and the damper installation must meet all the codes and regulatory requirements in the area where the work is done.
- B. Fire/Smoke dampers shall be as manufactured by Greenheck, Ruskin, United Enertech, or prior approved equivalent in compliance with the above requirements.

2.11 SHEET METAL TURNING VANES

- A. Factory fabricated, single thickness, galvanized sheet metal. Shop fabricated duct turns must be submitted for approval prior to processing any work on project.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Sheet metal accessories to be installed in locations shown on drawings.
- B. Installation to be in accordance with manufacturer's published recommendations as well as applicable sections of the SMACNA manual.
- C. Provide all screws, bolts, nuts, inserts, and material required for attaching sheet metal to duct, walls, floors and ceilings.

3.02 CONNECTORS

- A. Ductmate, Ward, TDC and TDF connectors are allowed when fabricated and installed in strict compliance with manufacturer's instructions.

3.03 TURNING VANES

- A. Provide single thickness turning vanes in all 90 degree square elbows and elsewhere as indicated. Use acoustical turning vanes where indicated.

3.04 SEALING

- A. Seal air tight all ductwork connections to air distribution devices including, but not limited to, grilles, diffusers, registers, louvers, dampers, etc.

3.05 DUCT SIZES

- A. Indicated sizes are to the inside of acoustical linings. Increase the size of all sheet metal ducts as required to accommodate acoustical lining.

3.06 DUCT OPENINGS

- A. Construct duct openings at grilles or registers so that the plaster will not crack when the registers are attached.

3.07 PAINTING

- A. Paint the inside of all supply, return and exhaust ducts and dampers one coat of dead black paint whenever visible through the openings. Where the duct insulation is visible through the grilles, registers, or diffusers, the insulation must have a black finish.

3.08 FLEXIBLE CONNECTIONS

- A. Provide flexible connections at the intake and discharge of all air handling and air conditioning units and elsewhere as indicated.

3.09 MEASUREMENTS

- A. Before fabrication, check all ductwork with the building construction for dimensions, locations, clearances, etc. Make up duct with any necessary variations to conform to the details of the construction of the building, to suit the space available, and to fit the equipment furnished. The entire duct system must be substantially constructed, rigidly erected and free of any duct vibration or noises.

3.10 FIRE DAMPERS

- A. Install per the manufacturer's printed instructions and per the UL listing instructions for the exact fire damper provided.

3.11 CONCEALED DAMPER OPERATORS

- A. Install per the manufacturer's printed instructions and as detailed on the drawings.

3.12 TESTING

- A. Check work for satisfactory installation and performance.
- B. Where applicable, check duct connections, access doors, etc., for leakage and condensation and correct conditions found.

END OF SECTION

**SECTION 23 3416
HVAC FANS**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Requirements of Division 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Centrifugal wall and roof exhaust fans.
 - 2. Centrifugal exhaust fans for grease laden vapors.
 - 3. Dryer exhaust fans.
 - 4. Plenum fans.

1.03 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan performance ratings on actual Project site elevations.

1.04 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Fans shall have a Fan Energy Index (FEI) rating that meets or exceeds the requirements of the latest edition of ASHRAE 90.1.
 - 7. Fans shall be licensed to bear the Air Movement and Control Association International (AMCA) Certified Ratings Program (CRP) seal for FEI.
 - 8. The Fan FEI rating shall be indicated on the design documents and manufacturer product submittals to allow for compliance verification by the building official.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators for designing vibration isolation bases.
 - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
- C. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.
- D. Field quality-control test reports.
- E. Submit Equipment Operating and Maintenance Manuals. The following information shall be considered a minimum. Where applicable, provide information required for specific pieces of equipment.
 - 1. Personnel familiar with the operation and maintenance of the specific information shall prepare manuals.
 - 2. Equipment shall be identified as shown in the Schedules and on the Drawings.

3. Provide information in three ring binders. All sheets shall have reinforced punches. Tabbed dividers shall separate all sections. Drawings will be bound in the manual, or contained in envelopes bound into the manual.
4. Contents - Each volume shall contain the following minimum contents:
 - a. Installation including instructions for unpacking, installing, aligning, checking and testing. Foundation data, allowable piping loads, and electrical design shall be included.
 - b. Operating Instructions to provide pre-operational checks, start up and shut down, and description of all control modes. Include emergency procedures for all fault conditions and actions to be taken for all alarms. Procedures for long term storage shall be included.
 - c. Maintenance shall include preventive, and corrective. Schedules for test of other functions are to be included. Provide a list of tools required to service the equipment. Trouble shooting instructions to include a trouble-shooting guide shall be included.
5. Spare Parts List
6. Shop Drawing Data to include performance curves, data sheets, flow diagrams, wiring diagrams, and descriptive drawings.
 - a. In general, corrections or comments, or lack thereof, made relative to submittals during review shall not relieve the Contractor from compliance with the requirements of the drawings and specifications. Submittals are for review of general conformance with the design concepts of the project and general compliance with the contract documents. The Contractor is responsible for the final design conforming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating the work of all trades, and performing the work in a safe and satisfactory manner.
 - b. Provide a recommended list of spare parts to be provided.

1.05 REFERENCE STANDARDS

- A. These standards shall be considered as minimum requirements. This is a general list and not all standards listed are necessarily referenced elsewhere in this Section. Specific requirements of this Section and/or Drawings shall have precedence. The Architect shall resolve conflicts between published requirements.
- B. Titles and abbreviation of Federal, State and industry standards, technical societies, associations and institutes and other organizations, which may be used, are as follows:
 1. Air Diffusion Council (ADC)
 2. American Bearing Manufacturers Association (ABMA)
 3. Air Movement and Control Association (AMCA)
 4. American National Standards Institute (ANSI)
 5. Air Conditioning and Refrigeration Institute (ARI)
 6. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
 7. American Society of Mechanical Engineers (ASME)
 8. American Society for Testing and Materials (ASTM)
 9. Factory Mutual (FM)
 10. Institute of Electrical and Electronic Engineers (IEEE)
 11. National Institute of Standards and Technology (NIST)
 12. National Electrical Code (NEC)
 13. National Electrical Manufacturers Association (NEMA)
 14. National Fire Protection Association (NFPA)
 15. Occupational Safety and Health Administration (OSHA)
 16. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
 17. Underwriters Laboratories (UL)

1.06 QUALITY ASSURANCE

- A. All equipment of a given type included in this section shall be furnished by or through a single manufacturer or as specified on the schedules.
- B. Inspection by the Architect or failure to inspect shall not relieve the Contractor of responsibility to provide materials and perform the work in accordance with the documents.
- C. The Owner and Architect reserve the right to sample and test any materials after delivery and to reject all components represented by a sample that fails to comply with the specified requirements.
- D. An authorized representative of the manufacturer shall perform the initial startup of the equipment. The Owner and Architect shall witness startup. The use of local sales representatives to perform this work is not acceptable, unless the manufacturer provides documented evidence that the sales representative has been specifically trained for this work.
- E. All rotating parts of equipment shall be statically and dynamically balanced at the factory.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - 1. Fan failure.
 - 2. Motor Failure.
 - 2. Warranty Period: 3-year from date of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. All materials shall be inspected for size, quality and quantity against approved shop drawings upon delivery.
- E. Delivery schedule of all equipment shall be coordinated with the Contractor. Equipment ready for shipment prior to the agreed on shipping date shall be stored without cost to the Owner by the manufacturer.
- F. All materials shall be suitably packed for shipment and long term storage. Each package shall be labeled to indicate the project and the contents of each package. Where applicable, equipment numbers shall be marked on the container.
- G. All equipment shipped that is exposed such as on a flat bed truck shall be protected during transit. The equipment shall be protected from moisture, road salt, dirt and stones or other materials thrown up from other vehicles. Electrical components shall be protected as above, but with special attention to moisture. The method of shipment protection shall be defined in the submittals.
- H. Instruction for the servicing and startup of equipment in long term or prolonged storage shall accompany each item.
- I. All materials shall be stored in a covered dry location off of the ground. When required to protect the materials they shall be stored in a temperature-controlled location.

1.09 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. Roof penetrations requirements are specified in Division 07.

1.10 ELECTRIC MOTORS

- A. All motors furnished shall be designed, manufactured, and tested in accordance with the latest applicable standards of NEMA, ANSI, IEEE, and ASTM. As a minimum requirement, all motors shall conform to the latest applicable sections of NEMA Standard No. MG-1. Motors must meet or exceed CEE Premium Efficiency™ full load efficiencies. The Consortium for Energy Efficiency (CEE), a national, non-profit public benefits corporation, promotes the manufacture and purchase of energy-efficient products and services.
- B. Motors shall be wound for 200, 230, 460, 230/460 or 575-volt, three-phase, 60-hertz, 1.15 service factor.
- C. Windings shall be copper magnet wire rated at 200° C and moisture resistant. Magnet wire insulation varnish must be of a type designed to resist transient spikes (such as Inverter Spike Resistant™ ISR), high frequencies, and short time rise pulses produced by inverters. Motor insulation system shall comply with NEMA MG1-1998 Part 31.4.4.2.
- D. Insulation shall be a Class F, non-hygroscopic varnish. The maximum permissible temperature for the insulation is not exceeded when the motor operates at service factor load in a 40°C ambient. Magnet wire shall have a service coating equivalent in thickness to a commercial "heavy" coating. The combination of magnet wire and varnish when tested in accordance with IEEE No. 57, latest revision, shall show a thermal rating of not less than 150°C for a duration of 30,000 hours life. Normal temperature rises for 1.0 service factor operation shall not exceed a Class B rise.
- E. The motor manufacturer shall confirm that motors used to power equipment are provided with bearings that will provide a bearing life equal to the driven equipment or better. Confirmation shall be included with shop drawing submittal.
- F. Electric motors enclosures in NEMA frame sizes shall conform to the following requirements, unless otherwise specified:
 - 1. Clean, Dry Areas – Open-Drip Proof (ODP)
 - 2. Outdoors – Totally Enclosed Fan Cooled (TEFC)
 - 3. Process Areas (NOT Div. 1 or 2) – TEFC
 - 4. Div. 1 or 2 Classified Areas - Explosion Proof (XP)

1.11 SPARE PARTS

- A. Spare parts shall include all special items on the manufacturer's standard list of spare parts
- B. In addition to special items, the following spare parts shall be provided:
 - 1. Furnish all special tools required for normal operation and proper servicing of the equipment.
 - 2. Spare parts shall include all items on the manufacturer's standard list of spare parts and the following for each unit:
 - a. Belts: 2 set(s) for each belt-driven unit.

PART 2 PRODUCTS

2.01 GENERAL

- A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard quality, grade, type, size, physical arrangement, performance characteristics and availability.
- B. Fans shall be factory assembled, complete with fan wheel, fan housing or cabinet, bearings, drives, drive guard, motor, motor base, unit base and vibration isolators, dampers and bird screens unless otherwise specified. All fans shall be provided with lugs, brackets or field supplied devices to allow the fan to be firmly bolted to the structure or fastened to specified vibration isolators. The lugs, brackets or field supplied devices shall be sized to withstand the expected seismic loads for the area and type of application. Location of the attachments

shall be based on the equipment being hung or base mounted as shown on the Drawings and the schedules.

- C. All fans shall be statically and dynamically balanced prior to shipment from factory.
- D. Unless otherwise noted, all fans shall be Class 2 construction per AMCA Standard 99.
- E. Where belt drives are used, motors shall be provided with adjustable slide bases. Adjustable sheaves and slide bases shall be selected so that the midpoint of the adjustable range matches the fan schedule data. Drives selected shall have a safety factor of 1.5 times motor horsepower.
- F. All fans shall be AMCA certified for air performance and sound ratings tested in accordance with AMCA 300.
- G. Motors shall be selected to be non-overloading over the entire operating range of the equipment and for the reasonable expected temperature and humidity. A safety factor of 25 percent will be added to all motors up to and including 50 horsepower. A safety factor of 15 percent will be added to all motors over 50 horsepower. Motors indicated in the schedules are to be considered a minimum. The schedule sizing is not to limit compliance with the above requirements.
- H. For motors operated by solid-state speed controllers, motor horsepower and disconnect shall be adjusted to prevent motor overloading conditions.
- I. Fans shall be assembled with OSHA shaft and motor guards. Provide access for greasing bearings, tachometer readings of fan and motor speed without removing the cover. Cover shall be properly ventilated to prevent motor overheating.
- J. Ductwork connections to units that require corrosion resistant coatings shall be made with flanges. Flanges shall be factory drilled before coating. Resilient washers suitable for the environment shall be used to protect the coating from the bolts in the flange. The use of self tapping screws or other fastening methods that will damage the coating are not acceptable.
- K. The noise level of the equipment operating in the field shall not exceed 85 dBA overall sound pressure level (referenced to 20 micro pascals) at a distance of 3-ft from equipment surfaces. Provide octave band sound data if another noise level is specified in the schedule or if sound data submission is specified in the schedules.
- L. Refer to Section 23 05 48 for general requirements for vibration isolators. Adhere to those requirements and the specific requirements in this Section.
- M. Provide inlet and/or outlet safety screens for fans that are not directly duct connected.
- N. Roof mounted fans shall be provided with factory fabricated insulated roof curbs. Roof curb height shall be determined based on a minimum equipment base installed height of 18 inches above finished roof level.
- O. Roof curbs shall be furnished, as shown on product drawings.
- P. Roof curbs shall be designed to withstand up to 60 psf hurricane force winds with equipment attached. Roof curb design shall include required accessories to attach the roof curb properly and securely to the building structure and to the equipment. Roof curb shall be provided with Certificate of Compliance from an independent certifying Professional Engineer clearly indicating that it meets high wind design requirements.
- Q. Roof curbs shall be shipped loose for installation prior to unit installation.

2.02 BEARINGS

- A. Grease lubricated bearings (except where driven by motors smaller than 1/2 Hp) shall be equipped with Zerk lubrication fittings and with provision for automatic relief of lubricant pressure away from fan wheel. The latter may be accomplished by either built-in relief devices or automatic ball-and-spring relief fittings at the bottom of the bearing housing.
- B. Pressure relieves shall be located outside of the units and shall be visible from maintenance locations. Lubrication fittings shall be located to be easily accessible from maintenance or

operating levels. Where necessary, extension tubes shall be provided to bring the service fitting to an accessible location and the relief visible from the same location.

- C. Bearings for all equipment in the schedule below shall have heavy-duty grease lubricated ball or roller bearings. Bearings shall have ample thrust provision to prevent end play during the normal life of the bearing. Unless specifically noted otherwise, all fans shall have bearings for both the equipment and motors with the following ABMA L-10 life.
 - 1. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.
 - 2. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.
- D. For systems with bearings requiring L-10 lives of 100,000 hours or greater, the equipment supplier shall provide calculations for both the equipment bearings and the motor bearings to confirm the bearing selections. For belt drives, the calculations shall include the effect of the sheave size, number of belts, the sheave location on the shaft, and the location of the motor to the driven sheave.
- E. The equipment manufacturer shall provide confirmation of the required life based on the actual drive components. For motors 50 horsepower and greater, the bearing life calculations for both the equipment bearings and the motor bearings shall be provided.
- F. When bearings are not accessible, extended supply and relief fittings shall be supplied. Both supply and relief fittings shall terminate in the same location.

2.03 FLAME AND SMOKE RATINGS

- A. All materials, including adhesives, surface coatings, sealers, assemblies of several materials, insulation, jacketing, finish, etc, shall have flame spread ratings not over 25 (fire resistive) and smoke development ratings not over 50 and fuel contributed rating not over 50, as established by tests conducted in accordance with the Federal Standard 00136B, National Bureau of Standards Radiant Energy Fire Test and the National Fire Code of the NFPA.
- B. These requirements shall apply to all circumstances whether the materials are field applied or have been applied by a manufacturer in his/her shop, or elsewhere, prior to delivery to the project for installation.

2.04 V-BELT DRIVE

- A. V-belt drives shall consist of the driver and driven sheaves and one or multiple matched V-belts. Drives furnished to transmit less than 3/4 HP may be a single groove, single belt type. Drives to transmit 3/4 HP or more shall consist of at least two belts. Belts smaller than "A" cross-section shall not be used.
- B. Each sheave shall be grooved to match the belt selection, bored and keyed to fit the receiving shaft, and grooves shall be in parallel planes exactly perpendicular to the bore for the full 360 degrees. Sheaves shall have keys and setscrews. Sheave material may be cast iron.
- C. The drive shall be sized 1.5 times the motor nameplate rating and also shall have ample strength to start the driven equipment by full voltage across-the-line motor starting.
- D. Where variable speed drive is specified, the drive sheave shall be of the variable pitch type which will provide a 5 percent speed variation of the driven equipment at the nominal rated speed. However, the higher speed side shall not cause the driven equipment to draw more than full nameplate rating horsepower from the driver.

2.05 CENTRIFUGAL UTILITY FANS

- A. Fans shall be centrifugal type. Unless spark resistant construction or other materials of construction are specified, fans shall be all welded steel construction with backward inclined airfoil blades continuously welded to the wheel flange and back plate. Fan housings are to be constructed of heavy gauge steel with sides and scroll continuously welded. Bearings shall be pillow block type rigidly mounted on steel structural members. Shaft shall be solid, turned, ground and polished hot-rolled steel with keyways, keys and set-screws for attachment of both the fan wheel and drive sheave and countersunk at drive end for tachometer readings. Shaft shall be statically and dynamically balanced and selected for continuous

operation at maximum rated fan speed and motor horsepower. Shaft shall be designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

- B. 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. Twin City Fan Company.
 - 2. Loren Cook Company.
 - 3. Greenheck
 - 4. PennBarry
 - 5. Or prior approved equivalent
- C. Description: Factory-fabricated, assembled, tested, and finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure.
- D. Housings: Formed panels to make curved-scroll housings with shaped cutoff, with doors or panels to allow access to internal parts and components.
 - 1. Panel Bracing: Steel angle or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - 2. Horizontally split, bolted-flange housing.
 - 3. Spun inlet cone with flange.
 - 4. Outlet flange.
- E. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - 1. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 - 2. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 3. Belts: Oil resistant, non-sparking, and non-static; matched sets for multiple belt drives.
 - 4. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - 5. Motor Mount: Adjustable for belt tensioning.
- F. Accessories:
 - 1. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.
 - 2. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.
 - 3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
 - 4. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
 - 5. OSHA Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

2.06 IN-LINE CENTRIFUGAL FANS

- A. Inline centrifugal fans shall have flanged inlet and discharge, wheel inspection door, and V-Belt drives. Belt drive shall have a shroud over the belt in the air stream. Wheel shall be backward inclined type, constructed of aluminum and containing a matching inlet venture for optimum unit performance. Mounting brackets shall be provided per specific fan mounting orientation. Unless spark resistant construction or other materials are specified on the schedule, fan shall be of steel construction with steel or aluminum wheel.

- B. 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. Twin City Fan Company.
 - 2. Loren Cook Company.
 - 3. Greenheck
 - 4. PennBarry
 - 5. Or prior approved equivalent.
- C. Description: Factory-fabricated, assembled, tested, and finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure.
- D. Housings: The fan housing shall be square in shape and readily attachable to building ductwork. Unit side panels shall be removable for easy access for maintenance and service. The power assembly shall be removable as a complete module through the side access panel. Fan housings shall have universal mounting brackets to accommodate horizontal and vertical installations. Fans shall bear a permanently attached nameplate displaying model and serial number of the unit.
- E. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - 1. Service Factor Based on Fan Motor Size: 1.5.
 - 2. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 - 3. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 4. Belts: Oil resistant, non-sparking, and non-static; matched sets for multiple belt drives.
 - 5. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - 6. Motor Mount: Adjustable for belt tensioning.
- F. Accessories:
 - 1. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.

2.07 PROPELLER FANS

- A. Propeller fans shall be steel construction with cast aluminum, fabricated steel or aluminum propellers. Plastic fan propellers are not acceptable. Fans shall be provided with discharge safety screen if not directly connected to ductwork. Provide neoprene vibration isolation at metal contacts and permanently lubricated, sealed ball bearings. When spark resistant construction is specified in the schedule, all electrical components shall be explosion proof. Unless spark resistant construction or other materials of construction are specified on the schedules housing shall be steel or aluminum.
- B. 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. Twin City Fan Company.
 - 2. Loren Cook Company.
 - 3. Greenheck
 - 4. PennBarry
 - 5. Or prior approved equivalent.

2.08 CENTRIFUGAL WALL AND ROOF EXHAUST FANS

- A. Centrifugal wall and roof exhaust fans shall be furnished with removable discharge safety/bird screen and inlet safety screen if not directly connected to duct work. Motor and drive shall be located out of the exhaust air stream. Curbs shall provide level fan mounting surfaces regardless of roof pitch. Provide neoprene vibration isolation at metal contacts and permanently lubricated, sealed ball bearings. Fan wheel shall be backward inclined. When spark resistant construction is specified in the schedule all electrical components shall be explosion proof. Fans shall be aluminum construction with spun aluminum drive housing and shroud unless other materials of construction are specified on the schedule.
- B. 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. Twin City Fan Company.
 - 2. Loren Cook Company.
 - 3. Greenheck
 - 4. PennBarry
 - 5. Or prior approved equivalent.

2.09 CENTRIFUGAL ROOF EXHAUST FAN FOR GREASE LADEN VAPORS

- A. The fan shall be constructed of heavy gauge painted steel for aesthetics. Fan scroll and discharge duct shall be continuously welded to prevent grease leakage. Fan shall include integral hinges at the base to allow the fan to swing away for easy cleaning of the duct in compliance with NFPA-96. Hinges shall be designed to limit the amount of travel, preventing damage to the fan or roof. The hinged section of the fan shall be provided with heavy gauge, oversized handles welded in place to allow safe, fast and easy opening. Fan shall be ETL listed to UL705 and UL762 Standards.
- B. 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. CaptiveAire
 - 2. Greenheck
 - 3. Or prior approved equivalent.
- C. Description: Factory-fabricated, assembled, tested, and finished, belt-driven centrifugal fans consisting of wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure.
- D. Wheel: The fan wheel shall be centrifugal backward inclined and non-overloading. Wheels shall be balanced in two planes and done in accordance with AMCA standard 204-96, Balance Quality and Vibration Levels for Fans. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency and reduce noise. The wheel shall be heavy gauge welded steel. In the event that balancing weights are required they shall be riveted or welded to the blades or wheel. The wheel inlet shall overlap the fan base inlet for maximum performance and efficiency. The wheel shall be firmly attached to the motor shaft with set screws.
- E. Grease Spout: The grease drain shall be constructed of steel pipe, 2" NPT welded into place to prevent grease leakage.
- F. Safety Disconnect Switch: A safety disconnect switch shall be standard on all HRE units with open drip proof motors. Switches shall be installed in a NEMA3R enclosure and mounted to exterior of wind-band for easy access.

2.10 DRYER VENT FANS

- 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. Housings must be resistant to corrosion. The design of the inlet and

discharge area must assure minimum lint build-up. It must have a service door that can be opened for easy cleaning and service. The ventilator must be rated for an operating temperature of 175°F. The backward inclined impeller shall be made of cast aluminum and be completely in balance.

- B. 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. Enervex Inc.
 - 2. Or prior approved equivalent.
- C. Description: Factory-fabricated, assembled, tested, and finished, belt-driven centrifugal fans consisting of wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure.
- D. Housings: The fan housing shall be 3/16" cast aluminum. One coat of grey hammerpaint is applied for added corrosion resistance.
- E. Motor: The motor must be a maintenance-free, variable speed motor with pre-lubricated and sealed ball bearings. The motor shall be factory warranted by the ventilator manufacturer to operate at frequencies as low as 8Hz for 3-phase motor. The bearings must be of a high temperature type with a minimum rating of 320°F. The motor is mounted outside the airstream and shall be at least Class A insulated with a temperature rating of minimum 221°F and rated as shown on the schedule. The motor must be a totally enclosed, fan-cooled (TEFC) motor that does not need an exterior cooling fan. To ensure motor longevity the motor shall be inverted-duty rated and not operate at speeds above 1720 RPM. The modulating exhaust control must be able to maintain a constant pressure between 0.00" W.C. and 0.6" W.C with a tolerance of 0.01" W.C. by modulating the speed of the ventilator. The control enclosure shall be NEMA 4X rated and suitable for outdoor installations. The controls shall include a transducer, XTP and a duct probe with tubing, to be located in the duct as shown on the manufacturer's submittal. The XTP shall be rated for outdoor installations and field wired to the modulating exhaust control.
- F. Compliance Requirements:
 - 1. UL378-Draft Equipment
 - 2. CSA-CAN3-B255-M81-Mechanical Flue Gas Exhausters
 - 3. Complies with and meets Type B, Spark Resistant Construction per AMCA staard 99-0401 classifications of Spark Resistant Construction.

2.11 PLENUM FANS

- A. Fans shall be designed without a scroll type housing and shall incorporate a non-overloading type backward inclined airfoil blade wheel, heavy-gauge reinforced steel inlet plate, structural steel frame, and shaft and bearings.
- B. 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. Twin City Fan Company.
 - 2. Loren Cook Company.
 - 3. Greenheck
 - 4. PennBarry
 - 5. Or prior approved equivalent.
- C. Description: Factory-fabricated, assembled, tested, and finished, belt-driven centrifugal fans consisting of wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure.
- D. Wheels: Wheels shall have a spun non-tapered style blade retaining ring on the inlet side to allow higher efficiencies over the performance range of the fan.

- E. Shafts: Shafts shall be AISI 1040 or 1045 hot rolled steel, accurately turned, ground, polished, and ring gauged for verification. Shafts shall be sized for the first critical speed of at least 1.43 times the maximum speed. All shafts must be dial indicated for straightness after the keyways are cut and straightened as required.
- F. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - 1. Service Factor Based on Fan Motor Size: 1.5
 - 2. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 - 3. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 4. Belts: Oil resistant, non-sparking, and non-static; matched sets for multiple belt drives.
 - 5. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - 6. Motor Mount: Adjustable for belt tensioning.

2.12 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install centrifugal fans level and plumb.
- B. Support floor-mounting units using spring isolators having a static deflection of 1 inch. Vibration devices are specified in Section 23 05 48.
 - 1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.
- C. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Section 03 - Cast-in-Place Concrete.
- D. Install floor-mounting units on concrete bases designed to withstand, without damage to equipment, the seismic force required by authorities having jurisdiction. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- E. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Section 23 05 48 - Vibration Isolation.
- F. Install units with clearances for service and maintenance.
- G. Label fans according to requirements specified in Division 22 Section "Mechanical Identification."

3.02 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 22 and 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final

duct connections with flexible connectors. Flexible connectors are specified in Section 23 32 00 – Sheet Metal Accessories.

- B. Install ducts adjacent to fans to allow service and maintenance.
- C. Install line-sized piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain.
- D. Ground equipment according to Section 26 05 26 - Grounding and Bonding.
- E. Connect wiring according to Section 26 05 19 - Low Voltage Electrical Power Conductors & Cables.

3.03 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Refer to Section 23 05 93 – Testing, Adjusting & Balancing for testing adjusting, and balancing requirements.
 - 10. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION

SECTION 23 3620
VARIABLE VOLUME TERMINALS WITH ELECTRIC HEAT

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish and install Single Duct Variable Volume Terminal Units of the sizes and capabilities as indicated on the drawings. Units shall be pressure independent with DDC controls. Units shall reset to any flow between 0 and the maximum cataloged airflow as allowed by the specific controller.
- B. The entire terminal unit shall be designed and built as a single unit. The units shall be provided with a primary variable air volume damper that controls the air quantity in response to a DDC thermostat. The units shall also include electric reheat where indicated on the variable volume terminal schedule. The space limitations shall be reviewed carefully to insure that all units will fit into the space allowed.
- C. Unit casing shall be 22 gauge galvanized steel with round or flat oval inlets with 5 1/2" deep inlet duct collar for field connection. Outlets shall be rectangular and configured for slip and drive connections. Casing leakage downstream of the damper shall not exceed 1% @ 1" w.g. High side casing leakage shall not exceed 2% @ 3" w.g.
- D. Damper assemblies of 16 gauge galvanized steel shall be multiple opposed blade construction arranged to close at 45 degrees from full open to minimize air turbulence and provide near linear operation. Damper blades shall be fitted with flexible seals for tight closure and minimized sound generation. Damper blades shall be screwed through the shaft to insure that no slippage occurs. Blade shafts shall pivot on corrosion free Celcon® bearings. In the fully closed position, air leakage past the closed damper shall not exceed 2% of the nominal catalog rating at 3" w.g. inlet static pressure as rated by ASHRAE Standard 130.
- E. The terminal units shall be capable of operation as described herein with an inlet static pressure of 0.10" w.g. from 0 to 2000 fpm. Each unit shall be complete with factory mounted DDC controls. Gauge tap ports shall be supplied in the piping between the flow pick up and the controller.
- F. Each unit shall be constructed with single point electrical connections. All electrical components shall be ETL or UL listed or recognized and installed in accordance with the National Electrical Code. All electrical components shall be installed in a control box. The entire assembly shall be ETL listed and so labeled. Each unit with an electric heater shall also be UL or ETL listed specifically with the heater as a component of the terminal unit device.
- G. Each unit shall be internally lined with minimum 3/4" thick, 1.5 lb. density fiberglass insulation. Units shall meet NFPA 90A and UL 181 standards. Edges shall be sealed against airflow erosion.
- H. All sound data shall be compiled in an independent laboratory and in accordance with the latest version of ARI Standard 880 and ANSI/ASHRAE Standard 130. All units shall be ARI certified and bear the ARI certification label.

1.02 SUMMARY

- A. Furnish and install all air terminal units herein specified and as indicated on the Drawings.

1.03 REFERENCE STANDARDS

- A. All air terminal units shall be designed, manufactured, and tested in accordance with the latest applicable industry standards including the following:
 - 1. ANSI/ASHRAE Standard 130-96.
 - 2. ARI Standard 880-98.
 - 3. Underwriters Laboratories UL Standard 1995.
 - 4. Underwriters Laboratories UL Standard 1996.

1.04 QUALITY ASSURANCE

- A. All equipment and material to be furnished and installed on this Project shall be UL or ETL listed, in accordance with the requirements of the authority having jurisdiction, and suitable for its intended use on this Project. Space limitations shall be reviewed to ensure that the equipment will fit into the space allowed.
- B. All equipment and material to be furnished and installed on this Project shall be run tested at the factory and results of that testing shall be tabulated and provided to the engineer when the equipment ships to the job site.

1.05 SUBMITTALS

- A. The following submittal data shall be furnished according to the Conditions of the Construction Contract, Division 1 Specifications, and Section 220500 General Mechanical Requirements and shall include but not be limited to:
 - 1. Single Duct Variable Air Volume Terminal Units, complete with capacity data, test data, construction details, physical dimensions, electrical characteristics, etc.

1.06 WARRANTY

- A. Manufacturer shall warrant equipment for a minimum of one year from project substantial completion.

PART 2 - PRODUCTS

2.01 UNAUTHORIZED MATERIALS

- A. Materials and products required for the work of this section shall not contain asbestos, polychlorinated biphenyl's (PCB) or other hazardous materials identified by the Engineer or Owner.

2.02 ACCEPTABLE MANUFACTURERS

- A. These Specifications set forth the minimum requirements for single duct VAV terminal units. If they comply with these Specifications, single duct VAV terminal units manufactured by one of the following manufacturers will be acceptable:
 - 1. Nailor Industries
 - 2. Price
 - 3. Titus
 - 4. Enviro-Tec

2.03 SINGLE DUCT AIR VOLUME TERMINAL UNITS WITH ELECTRIC RE-HEAT

- A. Furnish and install single duct VAV terminal units as indicated on the Drawings. The units shall be designed and built as a single unit and provided with a primary variable air volume damper that controls the primary air quantity in response to a temperature control signal. The damper construction shall be rectangular with multiple opposed blades designed to operate on a 45° arc. Blades shall be 16 gauge galvanized steel, single thickness construction with heavy-duty gasket glued to the blades. Units shall be suitable for pressure independent operation with digital (DDC) controls. The units shall contain a damper assembly as described above and electric re-heat coils where scheduled and/or indicated on the Drawings. The space limitations shall be reviewed carefully to ensure all terminal units will fit into the space provided including National Electric Code clearances required in front of all panels containing electrical devices. Unit shall be fully lined with minimum 3/4" thick, 1.5 lb. density fiberglass insulation that complies with NFPA 90A for fire and smoke resistivity and UL 181 for erosion.
- B. Any exposed edges shall be coated with approved sealant to prevent erosion. Casing leakage shall not exceed 2% of terminal rated airflow at 1.5" w.g. interior casing pressure. All high side casing joints shall be sealed with approved sealant and high side casing and damper leakage shall not exceed 2% of terminal rated airflow at 3" w.g. Unit casing shall be minimum 22 gauge, galvanized steel with round or flat oval inlets and rectangular outlets.

- C. Terminal unit manufacturer shall provide flow curves for the primary air sensor clearly labeled and permanently attached on the bottom or side of each terminal unit. At an inlet velocity of 2000 fpm, the differential static pressure for any unit size, 4 - 16 shall not exceed 0.10" w.g. for the basic unit.
- D. The unit shall include all equipment and controls as required to provide a complete and operating system with at least the following:
 - 1. Single point electrical connection for the voltage/phase as scheduled in the Contract Documents. See Electrical Drawings for power feeder arrangements.
 - 2. Individual overcurrent protection devices as required to protect individual units and transformers.
 - 3. The primary inlet shall be equipped with an inlet collar sized to fit the primary duct size shown on the Drawings. The inlet collar shall provide at least a 5 1/2" length with a 1/8" high raised single or double bead located approximately 11/2" from the inlet connection. The primary airflow (cfm) settings shall be clearly and permanently marked on the bottom of the unit along with the terminal unit identification numbers. Each terminal unit shall incorporate a Nailor Diamond Flow sensor with four pick up points on each side to insure that with typical duct turbulence, the controller fidelity shall be +/- 5% of set volume even with a hard 90° elbow at the inlet. Static variation of 0.5" w.g. to 6.0" w.g. shall not affect the flow reading. Provide a transformer with 24 volt AC secondary to provide power for the unit's controls. The VAV terminal unit manufacturer and the Building Controls Subcontractor shall verify compatibility of the multipoint flow sensors with transducer and DDC microprocessor.
 - 4. The outlets shall be rectangular and suitable for slip and drive duct connections. Casing shall have mounting area for hanging by sheet metal straps from a concrete slab or shall be supplied with angle brackets for mounting on all thread rods.

2.04 ELECTRIC RE-HEAT COILS

- A. Electric re-heat coils shall be ETL listed. Coils shall be factory mounted on the unit discharge.
- B. Electric heating coils shall consist of open coils of high grade nickel and chromium resistance wire or nichrome elements and insulated with ceramic insulators in galvanized steel brackets, supported in heavy gauge galvanized steel frames. Each unit employing an electric heating coil shall be constructed and installed in accordance with the requirements of the local authorities and shall be UL or ETL listed specifically with the heater as a component of the terminal unit device.
- C. Coils shall have the capacities indicated in Contract Documents. Coils rated up through 16.5 kW shall be single phase, 347 volt, 60 hertz and coils larger than 16.5 kW shall be three phase, four wire, 208, 480 or 600 volt, 60 hertz. Coils shall be available in one, two or three stages.
- D. Terminal bolts, nuts and washers shall be of corrosion resistant materials. Coils shall be constructed so the installation may be accomplished in accordance with the provisions of the National Electrical Code, for zero clearance. Coils shall be given a 2000 volt dielectric test at the factory.
- E. Automatic reset thermal cutouts shall be furnished for primary protection with manually resettable limit switches in power circuits for secondary protection. Both devices shall be serviceable through terminal box without removing heating element from the terminal device. The air pressure safety cutout pickup probe shall be remotely mounted near the volume control damper for maximum fidelity.
- F. Heating coils shall have a terminal box and cover, with quiet type built-in magnetic step controlled contactors for each circuit, branch circuit fusing for each branch circuit on heaters over 48 amps per the NEC and an air flow safety interlock switch for installation in the heater control enclosure. Provide a 120 or 24 VAC control power transformer with an integral or

separately mounted primary and/or secondary overcurrent protection device in accordance with NEC requirements.

- G. All wiring of built-in devices shall be brought to clearly marked terminal strips. A complete wiring diagram shall be permanently attached to the heating coil panel cover.
- H. Electric heating coils shall be designed for operation with the DDC controller and control system.
- I. Electric heating coils and the associated control panels shall be constructed as a component of the entire terminal unit and mounted in the discharge attenuator downstream of the terminal unit. The resulting unit, including the heater and the VAV damper, shall be no longer than 37" (940) in length.
- J. The manufacturer shall prove adequate even airflow over the electric heating coil under the full range of airflow scheduled (minimum to maximum) to prevent uneven heating of the electric coils. The terminal device shall be listed in accordance with UL 1995 as a composite assembly consisting of the VAV terminal device and the electric heating device.

2.05 DIGITAL (DDC) CONTROLS (PRESSURE INDEPENDENT) FACTORY MOUNTING PROCEDURE

- A. The terminals shall be equipped with pressure independent direct digital controls supplied by the control contractor and mounted by the terminal unit manufacturer. The control contractor shall, in addition to sending the controls to the terminal unit manufacturer, provide technical data sheets for all components to be mounted, including dimensional data, mounting hardware and method, as well as application specific wiring and piping diagrams for each terminal type as depicted on the schedules and mechanical drawings.
- B. Controls shall be compatible with the pneumatic 'Diamond Flow' multi-point averaging flow sensor supplied by the terminal manufacturer. The sensor shall have four pick-up points on each side to ensure that controller fidelity shall be $\pm 5\%$ of set volume with any typical air turbulence in the duct and any typical flex inlet condition and with an inlet static variation of 0.05" w.g. to 6.0" w.g. (12 - 1500 Pa). The sensor shall amplify the sensed velocity pressure and provide a minimum differential pressure of 0.03" w.g. (7.46 Pa) at 500 fpm (2.54 m/s) inlet velocity. Flow measuring taps and flow curves shall be furnished with each terminal.
- C. Controls shall be configured and field calibrated in the field by the control contractor after terminal installation has been completed. Pneumatic tubing shall be UL Listed fire retardant (FR) type. Each terminal shall be supplied with a label showing unit type, size and tag location.
- D. The terminal manufacturer shall provide a Class 2, 24 VAC control transformer factory wired with internal current limiting protection and disconnect switch. All controls shall be installed in an approved NEMA 1 enclosure supplied and installed by the terminal manufacturer.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 23 6423
SCROLL WATER CHILLERS

PART 1 - GENERAL

1.01 SCOPE

- A. The requirements of the General Conditions, Supplementary Conditions, Division 1, and Drawings apply to all work herein.
- B. Provide Microprocessor controlled, multiple-scroll compressor, air-cooled, liquid chillers of the scheduled capacities as shown and indicated on the Drawings, including but not limited to:
 - 1. Chiller package
 - 2. Electrical power and control connections
 - 3. Chilled water connections
 - 4. Factory start-up
 - 5. Charge of refrigerant and oil

1.02 QUALITY ASSURANCE

- A. Products shall be Designed, Tested, Rated and Certified in accordance with, and installed in compliance with applicable sections of the following Standards and Codes:
 - 1. ANSI/ASHRAE Standard 15 – Safety Code for Mechanical Refrigeration
 - 2. ASHRAE 90.1 – Energy Efficiency compliance.
 - 3. ANSI/NFPA Standard 70 – *National Electrical Code* (NEC).
 - 4. ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
 - 5. ARI Standard 550/590 – Positive Displacement Compressors and Air Cooled Rotary Screw Water-Chilling Packages.
 - 6. Conform to Intertek Testing Services, formerly ETL, for construction of chillers and provide ETL/cETL Listing label.
 - 7. Manufactured in facility registered to ISO 9001.
 - 8. OSHA – Occupational Safety and Health Act
- B. Factory Test: Chiller shall be pressure-tested, evacuated and fully charged with refrigerant and oil, and shall be factory operational run tested with water flowing through the vessel.
- C. Chiller manufacturer shall have a factory trained and supported service organization that is within a 50 mile radius of the site.
- D. Warranty: Manufacturer shall Warrant all equipment and material of its manufacture against defects in workmanship and material for a period of five (5) years from date of substantial completion.

1.03 DELIVERY AND HANDLING

- A. Unit shall be delivered to job site fully assembled and charged with refrigerant and oil by the Manufacturer.
- B. Unit shall be stored and handled per Manufacturer's instructions.
- C. Protect the chiller and its accessories from the weather and dirt exposure during shipment.
- D. During shipment, provide protective covering over vulnerable components. Fit nozzles and open ends with plastic enclosures.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. York, Daikin Applied, Trane, Carrier or prior approved equivalent.

2.02 CHILLER MATERIALS AND COMPONENTS

- A. General: Install and commission, as shown on the schedules and plans, factory assembled, charged, and tested air cooled scroll compressor chiller(s) as specified herein. Chiller shall be designed, selected, and constructed using a refrigerant with Flammability rating of "1", as defined by ANSI/ASHRAE STANDARD - 34 *Number Designation and Safety Classification of Refrigerants*. Chiller shall include, but is not limited to: a complete system with not less than two refrigerant circuits, scroll compressors, direct expansion type evaporator, air-cooled condenser, refrigerant, lubrication system, interconnecting wiring, safety and operating controls including capacity controller, control center, motor starting components, and special features as specified herein or required for safe, automatic operation.
- B. Cabinet: External structural members shall be constructed of heavy gauge, galvanized steel coated with baked on powder paint which, when subject to ASTM B117, 1,000-hour, 5% salt spray test, yields minimum ASTM 1654 rating of "6".
- C. Louvered Panels (full unit): Painted steel as per remainder of unit cabinet, to protect condenser coils from incidental damage, visually screen internal components, and prevent unauthorized access to internal components. Factory installed.

2.03 COMPRESSORS

- A. Compressors: Shall be hermetic, scroll-type, including:
 - 1. Compliant design for axial and radial sealing
 - 2. Refrigerant flow through the compressor with 100% suction cooled motor.
 - 3. Large suction side free volume and oil sump to provide liquid handling capability.
 - 4. Compressor crankcase heaters to provide extra liquid migration protection.
 - 5. Annular discharge check valve and reverse vent assembly to provide low-pressure drop, vent shutdown and reverse rotation protection.
 - 6. Initial Oil charge.
 - 7. Oil Level sight glass.
 - 8. Vibration isolator mounts for compressors.
 - 9. Brazed-type connections for fully hermetic refrigerant circuits.

2.04 REFRIGERANT CIRCUIT COMPONENTS

- A. Each refrigerant circuit shall include: liquid line shutoff valve with charging port, low side pressure relief device, filter-drier, solenoid valve, sight glass with moisture indicator, thermostatic expansion valves, and flexible, closed-cell foam insulated suction line and suction pressure transducer.

2.05 HEAT EXCHANGERS

- A. Shell and Tube Type Evaporator:
 - 1. Direct expansion type with refrigerant inside high efficiency copper tubes, chilled liquid forced over the tubes by galvanized steel baffles.
 - 2. Constructed, tested, and stamped in accordance with applicable sections of ASME pressure vessel code for minimum 350 PSIG refrigerant side design working pressure and 150 PSIG water side design working pressure.
 - 3. Shell covered with 1-1/2 in., flexible, closed cell insulation, thermal conductivity of 0.26 BTU-in./(hr-ft²-°F) maximum. Water nozzles with grooves for mechanical couplings and insulated by Contractor after pipe installation.

4. Provide vent and drain fittings, and thermostatically controlled heaters to protect to -20°F ambient in off-cycle.
- B. Brazed-Plate Type Evaporator:
1. Evaporator shall be brazed-plate stainless steel construction capable of refrigerant working pressure of 450 psig and liquid side pressure of 150 psig.
 2. Brazed plate heat exchangers shall be UL listed.
 3. Exterior surfaces shall be covered with 1-1/2 in., flexible, closed cell insulation, thermal conductivity of 0.26 BTU-in./(hr-ft²-°F) maximum.
 4. Water nozzles shall be provided with grooves for field provided ANSI/AWWA C-606 mechanical couplings.
 5. Evaporator shall include vent and drain fittings and thermostatically controlled heaters to protect to -20°F ambient in off-cycle.
 6. A 40 mesh, serviceable wye-strainer and mechanical couplings shall be provided for field installation on evaporator inlet prior to startup.
- C. Air Cooled Condenser:
1. Coils: Internally enhanced, seamless copper tubes, mechanically expanded into aluminum alloy fins with full height collars. Subcooling coil an integral part of condenser. Design working pressure shall be 450 PSIG (31 bar).
 2. Fans: Shall be dynamically and statically balanced, direct drive, corrosion resistant glass fiber reinforced composite blades molded into a low noise, full-airfoil cross section, providing vertical air discharge and low sound. Each fan in its own compartment to prevent crossflow during fan cycling. Guards of heavy gauge, PVC (polyvinylchloride) coated steel.
 3. Fan Motors: High efficiency, direct drive, 6 pole, 3 phase, insulation class "F", current protected, Totally Enclosed Air-Over (TEAO), rigid mounted, with double sealed, permanently lubricated, ball bearings.

2.06 POWER AND ELECTRICAL REQUIREMENTS

- A. General: Automatic start, stop, operating, and protection sequences across the range of scheduled conditions and transients.
- B. Microprocessor Enclosure: Rain and dust tight NEMA 3R/12 (IP55) powder painted steel cabinet and gasket sealed door.
- C. Microprocessor Control Center:
1. Automatic control of compressor start/stop, anti-coincidence and anti-recycle timers, automatic pump down shutdown, condenser fans, evaporator pump, evaporator heater, unit alarm contacts, and chiller operation from 0°F to 125°F (-18°C to 52°C) ambient. Automatic reset to normal chiller operation after power failure.
 2. Remote water temperature reset via a Pulse Width Modulated (PWM) input signal or up to two steps of demand (load) limiting.
 3. Software stored in non-volatile memory, with programmed setpoints retained in lithium battery backed real time clock (RTC) memory for minimum 5 years.
 4. Forty-character liquid crystal display, descriptions in English (or Spanish, French, Italian, or German), numeric data in English (or Metric) units. Sealed keypad with sections for Setpoints, Display/Print, Entry, Unit Options & clock, and On/Off Switch.
 5. Programmable Setpoints (within Manufacturer limits): display language; chilled liquid temperature setpoint and range, remote reset temperature range, set daily schedule/holiday for start/stop, manual override for servicing, low and high ambient cutouts, number of compressors, low liquid temperature cutout, low suction pressure cutout, high discharge pressure cutout, anti-recycle timer (compressor start cycle time), and anti-coincident timer (delay compressor starts).

6. Display Data: Return and leaving liquid temperatures, low leaving liquid temperature cutout setting, low ambient temperature cutout setting, outdoor air temperature, English or metric data, suction pressure cutout setting, each system suction pressure, discharge pressure, liquid temperature reset via a ISN DDC or Building Automation System (by others) via PWM input as standard or a 4-20 milliamp or 0-10 VDC input or contact closure with optional BAS interface, anti-recycle timer status for each compressor, anti-coincident system start timer condition, compressor run status, no cooling load condition, day, date and time, daily start/stop times, holiday status, automatic or manual system lead/lag control, lead system definition, compressor starts/operating hours (each), status of hot gas valves, evaporator heater and fan operation, run permissive status, number of compressors running, liquid solenoid valve status, load & unload timer status, water pump status.
7. System Safeties: Shall cause individual compressor systems to perform auto shut down; manual reset required after the third trip in 90 minutes. Includes: high discharge pressure, low suction pressure, high pressure switch, and motor protector. Compressor motor protector shall protect against damage due to high input current or thermal overload of windings.
8. Unit Safeties: Shall be automatic reset and cause compressors to shut down if low ambient, low leaving chilled liquid temperature, under voltage, and flow switch operation. Contractor shall provide flow switch and wiring per chiller manufacturer requirements.
9. Alarm Contacts: Low ambient, low leaving chilled liquid temperature, low voltage, low battery, and (per compressor circuit): high discharge pressure, and low suction pressure.
10. Unit controls shall include the following minimum components:
 - a. Microprocessor with non-volatile memory. Battery backup system shall not be accepted.
 - b. Separate terminal block for power and controls.
 - c. Control transformer to serve all controllers, relays, and control components.
 - d. ON/OFF control switch.
 - e. Replaceable solid-state controllers.
 - f. Pressure sensors shall be installed to measure suction and discharge pressure. Thermistors shall be installed to measure cooler entering and leaving fluid temperatures as well as optional heat reclaim condenser entering and leaving fluid temperatures, and refrigerant pump down pressure and temperature.
11. Unit controls shall include the following functions:
 - a. Automatic circuit lead/lag.
 - b. Hermetic scroll compressors are maintenance free and protected by an auto-adaptive control that minimizes compressor wear.
 - c. Capacity control based on leaving chilled fluid temperature and compensated by rate of change of return-fluid temperature with temperature set point accuracy to 0.1° F (0.06° C).
 - d. Limiting the chilled fluid temperature pulldown rate at start-up to an adjustable range of 0.2° F to 2° F (0.11° C to 1.1° C) per minute to prevent excessive demand spikes at start-up.
 - e. Seven-day time schedule.
 - f. Leaving chilled fluid temperature reset from return fluid and outside air temperature.
 - g. Dual chiller control for parallel chiller applications without addition of hardware modules and control panels (additional thermistors and wells are required).
 - h. Timed maintenance scheduling to signal maintenance activities for strainer maintenance and user-defined maintenance activities.
 - i. Low ambient protection to energize cooler and optional heat reclaim or hydronic system heaters.

- j. Single step demand limit control activated by remote contact closure.
 - k. Generation of 0 to 10 vdc signal to control 3-way valve position when optional heat reclaim is employed.
 - l. Nighttime sound mode to reduce the sound of the machine by a user-defined schedule.
- D. Manufacturer shall provide any controls not listed above, necessary for automatic chiller operation. Contractor shall provide field control wiring necessary to interface sensors to the chiller control system.

2.07 POWER CONNECTION AND DISTRIBUTION

- A. Power Panels:
- 1. NEMA 3R/12 (IP55) rain/dust tight, powder painted steel cabinets with hinged, latched, and gasket sealed outer doors. Provide main power connection(s), control power connections, compressor and fan motor start contactors, current overloads, and factory wiring.
 - 2. Power supply shall enter unit at a single location, be 3 phase of scheduled voltage, and connect to individual terminal blocks per compressor. Separate disconnecting means and/or external branch circuit protection (by Contractor) required per applicable local or national codes.
 - 3. Control Transformer: Power panel shall be supplied with a factory mounted and wired control transformer that will supply all unit control voltage from the main unit power supply. Transformer shall utilize scheduled line voltage on the primary side and provide 115V/1Ø on secondary.
 - 4. Short Circuit Withstand Rating of the chiller electrical enclosure shall be (380, 400, & 460V: 65kA). Rating shall be published in accordance with UL508.
 - 5. Motor Starters: Motor starters shall be Variable Frequency Drive type with zero electrical inrush current. Wye-Delta, Solid State, and Across the Line type starters will not be acceptable.
- B. Exposed compressor, control and fan motor power wiring shall be routed through liquid tight, UV-stabilized, conduit.

2.08 ACCESSORIES

- A. Microprocessor controlled; factory installed Across the-Line type compressor motor starters as standard.
- B. Outdoor Ambient Temperature Control
 High Ambient Control (Factory Mounted):
 Permits unit operation above 115°F ambient.
 Low Ambient Control (Factory Mounted):
 Permits unit operation down to 0°F ambient.
- C. Control Power Transformer:
 Converts unit power voltage to 120-1-60 (500 VA capacity). Factory-mounting includes primary and secondary wiring between the transformer and the control panel.
- D. Power Factor Correction Capacitors:
 Provided to correct unit compressor factors to a 0.90-0.95.
- E. Condenser Coil Environmental Protection:
 Pre-Coated: Epoxy coated aluminum fin stock to guard from corrosive agents and insulate against galvanic potential.
- F. Flow Switch (Field-mounted):
 Vapor proof SPDT, NEMA 3R switch, 150 PSIG (10.3 bar), -20°F to 250°F (-28.9°C to 121.1°C).
- G. Service Isolation valves: Service suction and discharge (ball type) isolation valves are added to

unit per system. This option also includes a system high pressure relief valve in compliance with ASHRAE 15. (Factory-mounted.)

- H. Manufacturer shall provide a Hot Gas By-Pass: to Permit continuous, stable operation at capacities below the minimum step of unloading to as low as 5% capacity (depending on both the unit & operating conditions) by introducing an artificial load on the cooler. Hot gas by-pass is installed on only one refrigerant circuit.
- I. Vibration Isolation (Field-mounted):
1 Inch Deflection Spring Isolators: Level adjustable, spring and cage type isolators for mounting under the unit base rails.
- J. Victaulic Connections consists of (2) flange adapter for grooved end pipe (field-mounted).
- K. Low speed, reduce noise fans
 - 1. Provide the following options as required to meet scheduled sound performance data at all load points.
 - a. Low Sound fans, Low speed, reduced noise (Factory-mounted).
 - b. Compressor Sound Blankets (Factory-mounted)

SOUND POWER LEVELS (In Accordance with ARI Standard 370) – Octave Band Center Frequency, Hz (Equipped with Low Sound Fans and Acoustic Sound Blanket kit)										
Load %	Ambient (°F)	63	125	250	500	1K	2K	4K	8K	LWA
100.0	95.0	69.0	82.0	88.0	93.0	97.0	93.0	89.0	80.0	100.0

SOUND PRESSURE LEVELS in dB at 30.0 (ft.) ** (Equipped with Low Sound Fans and Acoustic Sound Blanket kit)										
Load %	Ambient (°F)	63	125	250	500	1K	2K	4K	8K	dBA
100.0	95.0	41.0	54.0	60.0	65.0	69.0	64.0	60.0	52.0	72.0

** Chiller is assumed to be a point source on a reflecting (hemispherical radiation)

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Rig and Install in full accordance with Manufacturer's requirements, Project drawings, and Contract documents.
- B. Location: Locate chiller as indicated on drawings, including cleaning and service maintenance clearance per Manufacturer instructions. Adjust and level chiller on support structure. If equipment provided exceeds height of scheduled chiller, installing contractor is responsible for additional costs associated with extending the height of parapet or screening walls/enclosures.
- C. Components: Installing Contractor shall provide and install all auxiliary devices and accessories for fully operational chiller.
- D. Electrical: Coordinate electrical requirements and connections for all power feeds with Electrical Contractor (Division 26).
- E. Controls: Coordinate all control requirements and connections with Controls Contractor.
- F. Finish: Installing Contractor shall paint damaged and abraded factory finish with touch-up paint matching factory finish.

END OF SECTION

**SECTION 23 7313
AIR DISTRIBUTION DEVICES**

PART 1 - GENERAL

1.01 SCOPE

- A. Furnish and install the following:
 - 1. Grilles & registers.
 - 2. Ceiling diffusers.

1.02 QUALITY ASSURANCE

- A. Air distribution devices shall be as manufactured by Nailor Industries or prior approved equal.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Arrange product delivery to minimize storage time. Store air distribution devices in cartons in position indicated on box until installation. Handle air devices with care to prevent damage to finishes.

PART 2 - PRODUCTS

- 2.01** See Drawing Schedule for Diffuser, Register and Grille requirements.

2.02 FINISHES

- A. Furnish all air distribution devices with prime coated and white baked enamel finish coat unless specified otherwise.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect air devices for scratches and dents after installation. Repair dents and touch up scratches. If damage is still visible replace device.

3.02 INSTALLATION

- A. Suspend ceiling air devices from structure on wire hangers or from rigid ductwork. Ceiling must not be used to support air distribution devices.
- B. Verify compatibility of air devices with specific ceiling types.

END OF SECTION

SECTION 23 7412
CENTRAL STATION AIR HANDLERS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Requirements of Section 01 including, but not limited to, General Requirements, Submittal Procedures, Quality Requirements, Product Requirements, Substitution Procedures, Operation and Maintenance Data, Demonstration and Training shall apply to all work under this section.

1.02 RELATED SECTIONS

- A. Section 23 0900 – HVAC Instrumentation and Control
- B. Section 23 0700 – Mechanical System Insulation

1.03 REFERENCES

- A. AMCA 300 - Reverberant Method for Sound Testing of Fans.
- B. AMCA 301 - Method for Publishing Sound Ratings for Air Moving Devices.
- C. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- D. ANSI/UL 900 - Test Performance of Air Filter Units.
- E. ARI 260 - Standard for Sound Rating of Ducted Air Moving and Conditioning Equipment
- F. ARI 410 - Standard for Forced Circulation Air-Cooling and Air-Heating Coils.
- G. ARI 430 - Standard for Central Station Air Handling Units.
- H. ARI 1060 Air-To-Air Energy Recovery Ventilation Equipment
- I. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.
- J. ASTM B 117 - Standard Practice for Operation Salt Spray Apparatus
- K. NEMA MG1 - Motors and Generators
- L. NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.
- M. SMACNA - HVAC Duct Construction Standards.
- N. UL 1995 - Heating and Cooling Equipment

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum ten (10) years documented experience, who issues complete catalog data on total product.
- B. Air Coils: Certify capacities, pressure drops and selection procedures in accordance with current ARI 410 Standard.
- C. Certify air-handling units in accordance with ARI 430.
- D. Units shall conform to AMCA 210 for fan performance ratings.
- E. Units shall conform to E.T.L. standards. Unit shall be ETL listed.
- F. Unit casing radiated sound ratings shall be reported in accordance with ISO 9614 parts 1&2 and ANSI S12.12.
- G. Motors covered by the Federal Energy Policy Act (EPACT) shall meet EPACT requirements.
- H. Damper performance shall comply with AMCA 500.
- I. Airflow Monitoring Stations shall be rated in accordance with AMCA 611-95 and bear a Certified Ratings Seal for Airflow Measurement Performance.
- J. Air-handling units shall be ISO 9001 certified.

K. Air-handling units shall be manufactured in an ISO 9002 certified facility.

1.05 SUBMITTALS

- A. Product Data and Record Documents:
- B. Submit unit performance including: capacity, nominal and operating performance.
- C. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
- D. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations. Indicate unit shipping split locations, and split dimensions, installation and operating weights including dimensions.
- E. Provide fan curves with specified operating point clearly plotted.
- F. Provide data on all coils as tested and certified per ARI standards.
- G. Submit data on electrical requirements. Include safety and start-up instructions. Wiring shall have smoke and flammability rating of 25/50 or better per test method of NFPA 262.
- H. Submit sound data certified to ARI 260.
- I. Base Rail Height Calculations: Provide calculations for required base rail heights to allow for proper condensate trapping per condensate drain details.
- J. Operation and Maintenance Data
 - 1. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists and wiring diagrams.
 - 2. Provide Operating and Maintenance (O&M) Manuals for air handling units. In addition to a full set of manuals with closeout documentation, each unit shall ship with its own manual permanently mounted inside the unit casing fan section in a watertight enclosure.
 - 3. Permanently mount condensate trapping calculation instructions within the unit O&M Manual that illustrates the unit casing at the condensate drain connection.
 - 4. Manufacturer's Instructions: Provide Start-up information and maintenance required prior to Start-up.

1.06 REGULATORY REQUIREMENTS

- A. Unit shall be manufactured to conform to UL 1995 Standard and shall be listed by either UL/CUL or ETL. Units shall be provided with listing agency label affixed to unit. In the event the unit is not UL/CUL or ETL approved, the contractor shall, at his/her expense provide for a field inspection by a UL/CUL or ETL representative to verify conformance. If necessary, contractor shall perform modifications to the unit to comply with UL/CUL or ETL as directed by the representative, at no additional expense to the owner.
- B. Certify air-handling units in accordance with ARI 430. If air-handling units are not certified in accordance with ARI 430, contractor shall be responsible for expenses associated with testing of units after installation to verify performance of fan(s). Any costs incurred to adjust fans to meet scheduled capacities shall be the sole responsibility of the contractor.
- C. Certify air-handling coils in accordance with ARI 410. If air-handling coils are not certified in accordance with ARI 410, contractor shall be responsible for expenses associated with testing of coils after installation to verify performance of coil(s). Any costs incurred to adjust coils to meet scheduled capacities shall be the sole responsibility of the contractor.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Units shall ship fully assembled up to practical shipping and rigging limitations. Units not shipped fully assembled shall have tags and airflow arrows on each section to indicate location and orientation in direction of airflow. Shipping splits shall be clearly defined on submittal drawings. Cost associated with non-conformance to shop drawings shall be the

responsibility of the manufacturer. Each section shall have lifting lugs or shipping skid to allow for field rigging and final placement of section.

- C. Deliver units to jobsite with fan motor(s), sheave(s), and belt(s) completely assembled and mounted in units. Unpainted units shall be shrink-wrapped for protection during shipment. Painted units shall be tarped for protection during shipment. Openings shall be protected against damage during shipping. Loose-shipped items shall be packed, protected and secured with units. Detailed packing list of loose-shipped items, illustrations and instructions for application shall be included.
- D. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish. Refer to specific manufacturer's recommendations for storage.

1.08 START-UP AND OPERATING REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters in place, bearings lubricated (if applicable), condensate properly trapped, piping connections verified and leak-tested, belts aligned and tensioned, all shipping braces removed, bearing set screws torqued, and fan has been test run under observation.

1.09 WARRANTY

- A. The equipment manufacturer shall provide, at no additional cost, a standard parts and labor warranty that extends a period of one (1) year from date of substantial completion. This warrants that all products are free from defects in material and workmanship and shall meet the capacities and ratings set forth in the equipment manufacturer's catalog and bulletins. Warranty work shall be performed by manufacturer's factory-trained and factory-employed technicians.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers not pre-approved, must obtain pre-approval in writing from consulting engineer prior to bid day. Alternates must comply with all performance and features as called for in this specification. Job will be awarded on the basis of specified equipment. Alternates may be evaluated and considered by engineer after the job is awarded.
- B. Manufacturer must clearly define any exceptions made to Plans and Specifications. Any deviations in layout or arrangement shall be submitted to consulting engineer prior to bid date. Acceptance of deviation(s) from specifications shall be in the form of written approval from the consulting engineer. Mechanical Contractor is responsible for expenses that occur due to exceptions made.
- C. Approved Manufacturers:
 - 1. Daikin Applied
 - 2. York – Indoor Solution Series
 - 3. Temtrol
 - 4. Carrier
 - 5. Or prior approved equivalent.

2.02 GENERAL

- A. Unit layout and configuration shall be as defined in project plans and schedule.
- B. Unit shall be complete with fans, motors, coils, dampers, controls, access doors and other components/options, as shown on product drawings, wiring diagrams, and as described in performance specifications.
- C. Fans and drives shall be balanced to limit vibration at operating speeds.
- D. Unit shall ship in one (1) piece whenever possible. Shipping splits shall be provided when necessary. Lifting lugs shall be provided where required for proper lifting.

- E. Provide 8" high unit base rail to support all sections of unit and raise unit for proper trapping. Unit base rail shall be chemically cleaned and coated with both a rust-inhibiting primer and finished coat of rust-inhibiting enamel. Contractor shall provide a housekeeping pad. Contractor shall coordinate required height of the housekeeping pad to properly trap unit.

2.03 UNIT CASING

- A. Unit shall be constructed of a complete structural frame with removable panels. Unit manufacturer shall ship separate segments so unit can be broken down for ease of installation in tight spaces. Unit shall have double wall, min. 2" thick, R-13 insulated panels for walls, roof, and floor. Exterior skin shall be galvanized sheet steel. Individual segments shall have stainless sheet steel interior liner. Casing finished to meet ASTM B 117 250-hour salt-spray test. The removal of side panels shall not affect the structural integrity of the unit. All removable panels shall be gasketed to minimize air leakage. Floor panels shall be double wall construction, designed to provide at most L/240 deflection when subjected to a 300 lb. load at mid-span. Floors shall be diamond tread heavy gauge aluminum tread plate. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.
- B. Construct casing sections capable of operating from -4"wg to +6"wg. Unit casing leakage rate shall not exceed 1% of full flow.
- C. Access panels and/or access doors shall be available on both sides of the unit in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance. If panels are not removable, then manufacturer shall provide access sections with doors between all internal components to ensure access and cleanability of the air handler.
- D. Double wall access doors shall be provided on sections as shown on drawings.
 - 1. Stainless steel hinges shall permit a 180° door swing.
 - 2. Access door shall be of the same material type as exterior/interior casing.
 - 3. Access door latches shall use a roller cam latching mechanism.
 - 4. View ports shall be double-pane tempered glass.
- E. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of all interior surfaces.
- F. Door hardware shall be surface mounted to minimize penetrations in the door casing that could lead to air leakage paths.
- G. All joints between exterior panels and structural frames, as well as joints between module frames, shall be properly sealed and gasketed to provide an air seal.
- H. Insulation - High density - Insulation shall be encased in double-wall casing between exterior and interior solid panel such that no insulation can erode to the airstream. Foil facing on insulation is not an acceptable alternate to double wall construction. Insulation shall have a minimum 3# density and shall be UL listed. The installation shall comply with NFPA-90A and B requirements and shall not allow for external condensate formation at air handling unit casing joints.
- I. Provide 8" high (min.) continuous heavy duty steel base rail to support the entire unit including all major AHU components. Bases shall be constructed of wide-flange galvanized steel I-beams or channels. Welded or bolted cross members shall be provided as required for lateral stability. Contractor shall provide supplemental steel supports as required to obtain proper operation heights for coil condensate drain trap as shown on drawings.
- J. AHUs shall be completely self supporting for installation on concrete housekeeping pad, steel support pedestals, or suspended as shown on drawings.
- K. The AHU bases shall be cleaned, primed with a rust inhibiting primer, and finished with rust inhibiting exterior enamel.

2.04 DRAIN PANS

- A. Primary and auxiliary drain pans shall be double wall with an insulation R-value of 6.25 hr-ft²-°F/(BTU-in).
- B. Drain pans shall comply with the requirements of ASHRAE 62 Standard.
 - 1. Drain pans shall be double sloped at least 1/8" per foot, and have no horizontal surfaces.
 - 2. Drain connection material shall be stainless steel.
 - 3. Drain pans shall drain to one point.
 - 4. Drain connections shall be welded to drain pans
 - 5. Drain pans shall have at least 1" clearance between pan and coil supports.

2.05 FANS

- A. Provide fans of type and class as specified on the schedule. Fan shafts shall be solid, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM to meet design specifications. Fans controlled by variable frequency drives shall be statically and dynamically tested for vibration and alignment at speeds between 25% and 100% of design RPM. If fans are not factory-tested for vibration and alignment, the contractor shall be responsible for cost and labor associated with field balancing and certified vibration performance. Fan wheels shall be keyed to fan shafts to prevent slipping. If not specified then provide a Class 2 plenum fan.
- B. Provide grease lubricated ball bearings selected for L-50 200,000-hour average life per ANSI/AFBMA 9. Greasable bearings shall have lubrication lines extended to the drive side of the unit. Lubrication lines shall be a clear, high-pressure, polymer to aid in visual inspection. Extend both grease lubrication lines to drive side of unit and rigidly attach to drive side bearing support with zerk fittings.
- C. Airfoil fans shall bear the AMCA Seal. Airfoil fan performance shall be based on tests in accordance with AMCA standard 210 and shall comply with the requirements of AMCA certified ratings programs for air and sound. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the contractor in order to avoid transmission of noise and vibration through the ductwork and building structure.
- D. Fan and motor assembly shall be internally mounted on a common base. Fan and motor base shall be spring isolated on a full width isolator support channel.
 - 1. Fan discharge shall be connected to cabinet via a flexible connection.
 - 2. Access doors shall be provided.
- E. Fans shafts shall be polished steel and sized such that the first critical speed will be at least 125% of the maximum operating speed for the fan pressure class. Shaft shall be coated with an anti-corrosion coating.
- F. Fan modules shall have a minimum of one access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components. Construct door(s) per Section 2.03 paragraphs D, E, and F.
- G. Fans shall have a sharply rising pressure characteristic extending through the operating range and continuing to rise beyond the peak efficiency to ensure quiet and stable operation. Fans shall have a non-overloading design with self-limiting horsepower characteristics and shall reach a peak in the normal selection area.
 - 1. Performance — Fans shall be tested in accordance with AMCA 210 and AMCA 300 test standards for air moving devices and shall be guaranteed by the manufacturer to deliver rated published performance levels.

2. Construction — Fans shall be designed without a scroll type housing and shall incorporate a non-overloading type backward inclined airfoil blade wheel, heavy-gauge reinforced steel inlet plate and structural steel frame.
 3. Frame and Inlet Panel — Inlet panels shall be of heavy-gauge reinforced steel construction. The inlet panel incorporates a removable spun inlet cone designed for smooth airflow into the accompanying inlet retaining ring of the fan wheel. A square, formed lip suitable for attachment of a boot connector shall surround the unit.
 4. Wheel — Wheels shall have a spun non-tapered style blade retaining ring on the inlet side to allow higher efficiencies over the performance range of the fan. Wheels shall have airfoil-shaped extruded aluminum blades. All hollow blade wheels shall be continuously welded around all edges. Wheels shall have twelve blades for better sound quality. All wheels shall be statically and dynamically balanced per ANSI/AMCA 204.
 5. Finish and Coating — The entire fan assembly shall be thoroughly degreased and deburred before application of a rust-preventative coating. Aluminum components shall be unpainted.
 6. Motors — Provide Premium Eff. with Aegis Shaft Grounding factory installed. Motor frames shall be cast iron – rolled steel frames are not acceptable.
 7. Fan Balancing — All fans prior to shipment shall be individually balanced. Maximum vibration shall be within the limits of ANSI/AMCA 204 Fan Application Category BV-4. Balance readings shall be taken by electronic type equipment in the axial, vertical, and horizontal directions on each of the bearings.
 8. Vibration Isolation — Fans shall not require spring isolators in order to meet the ANSI/AMCA 204 Fan Application Category BV-4 rating.
 9. Factory Run Test — All fans prior to shipment shall be completely assembled and test run as a unit at the specified operating speed or maximum RPM allowed for the particular construction type. Maximum vibration shall be within the limits of ANSI/AMCA 204 Fan Application Category BV-4. Balance readings shall be taken by electronic type equipment in the axial, vertical, and horizontal directions on each of the bearings.
 10. Backdraft Damper: Each Multiple Fan section to be provided with backdraft dampers for automatic isolation of individual fans.
 11. Blank off Panels: Each Multiple Fan section to be provided with one fan blank-off panel for service.
- H. Belts shall be enclosed as required by OSHA standard 29 CFR 1910 to protect worker from accidental contact with the belts and sheaves.

2.06 MOTORS AND DRIVES

- A. All motors and drives shall be factory-installed and run tested. All motors shall be installed on a slide base to permit adjustment of belt tension. Slide base shall be designed to accept all motor sizes offered by the air-handler manufacturer for that fan size to allow a motor change in the future, should airflow requirements change. Fan sections without factory-installed motors shall have motors field installed by the contractor. The contractor shall be responsible for all costs associated with installation of motor and drive, alignment of sheaves and belts, run testing of the motor, and balancing of the assembly.
- B. Fan motors shall be built in accordance with the latest NEMA and IEEE standards.
- C. Fan motors shall comply with ASHRAE 90.1 Standard.
- D. Motors shall be selected to operate continuously at 104 F (40 C) ambient without tripping of overloads. Motors shall have a ± 10 percent voltage utilization range to protect against voltage variation. Motors shall be in compliance with EPACT when applicable.
- E. Fan motors will be furnished in sizes, electrical power and starting characteristics as shown in performance specifications.

1. Fan motors will be rated for continuous, full load duty at 104°F (40°C) ambient temperature and 1.15 service factor.
2. Fan motors will be NEMA design ball bearing type.
 - a. Direct drive plenum fans will be coupled with motors that closely match required fan RPM.
3. Fan motors will be Open drip proof (ODP) or totally enclosed, fan cooled (TEFC)
4. Premium Efficiency Inverter ready per NEMA STD MG1 PART 31.4.4.2
5. Motors will be suitable for use with variable frequency drives, per NEMA MG-1 Part 30.
- F. Manufacturer shall provide for each fan a nameplate with the following information to assist air balance contractor in start up and service personnel in maintenance:
 1. Fan and motor sheave part number
 2. Fan and motor bushing part number
 3. Number of belts and belt part numbers
 4. Fan design RPM and motor HP
 5. Belt tension and deflection
 6. Center distance between shafts

2.07 AIRFLOW MONITORING STATION

- A. Refer to Specification 23 0913 - Airflow Measuring Devices.

2.08 COILS

- A. Coils shall be such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil. Red brass coil connections shall be extended through unit casing. Coil headers shall be copper unless otherwise noted.
- B. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.
- C. Construct coil casings of stainless steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.
- D. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.
- E. On stacked cooling coils, intermediate drain pans shall be installed between the coils. Intermediate drain pans shall have drop tubes to guide condensate to the main drain pan, thus preventing flooding of lower coils that would result in moisture carryover.

2.09 BASE-LEVEL DRAIN PANS

- A. Insulation shall be encased between exterior and interior walls. Units with cooling coils shall have drain pans under complete cooling coil section that extend beyond the air-leaving side of the coil to ensure capture of all condensate in section. Cooling coil drain pans shall be sloped in 2 planes, pitched toward drain connections to ensure complete condensate drainage when unit is installed level and trapped per manufacturer's requirements. See section 2.05, paragraph E for specifications on intermediate drain pans between cooling coils.
- B. Units with heating coils shall have a drain pan under complete heating coil section sloped in 2 planes and pitched toward drain connections to ensure proper drainage during cleaning and to capture water in the event of a coil failure.

- C. All drain pan connections supplied by unit manufacturer including, piping, and piping connections extending from stainless steel drain pans shall be constructed of stainless steel. The contractor is responsible to ensure the unit is installed level, trapped in accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate.
- D. Flat drain pans shall be acceptable in sections that may have incidental, but not continuous contact with moisture. Flat drain pans shall be accessible for cleaning.
- E. All drain pans shall be stainless steel.

2.10 FILTERS

- A. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter section shall have filter guides and access door(s) extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.3, paragraphs D, E, and F. Provide filter block offs as required to prevent air bypass around filters.
- B. Filter type, efficiency, and arrangement shall be provided as defined in project plans and schedule. Filters shall be removable from one side of filter section(s). Filters shall be 2" thick, pleated (minimum) 65% efficient, MERV-13, per ASHRAE 52.1-1992.
- C. Manufacturer shall provide one set of startup filters.

2.11 DAMPERS

- A. All dampers, with the exception of external bypass and multizones (if scheduled), shall be factory mounted. AHU outside air damper opening shall be sized to maintain a minimum air velocity of 300 feet per minute at 25% of design outside airflow rate. Dampers shall be premium ultra low leak and located as scheduled. Dampers shall be Ruskin CD60 double-skin airfoil design or prior approved equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 5 CFM/square foot at one inch water gauge and 9 CFM/square foot at 4 inches water gauge. All leakage testing and pressure ratings shall be based on AMCA Publication 500. Manufacturer shall submit brand and model of damper(s) being furnished.

2.12 AIR HANDLING UNIT SPECIALTIES

- A. Adjustable Frequency Drives (AFD):
 - 1. Refer to Section 23 0920.
 - 2. Where indicated on Drawings, furnish as a part of the unit assembly, with drive matched to motor without noise or vibration over the entire operating range. All VFDs provided for the project shall be from a single manufacturer. Contractor shall coordinate as necessary.
 - 3. All motors with AFDs shall be compatible with AFD and tested at the factory.
- B. Ultra Violet Germicidal Irradiation Systems:
 - 1. Provide Ultra Violet Germicidal Irradiation (UVGI) lamps. Lamps shall provide a minimum irradiance of 9 Watts per square foot at the cooling coil surface.
 - 2. UV lamps shall be located:
 - a. 12 inches downstream of cooling coils.
 - 3. Lamps shall be UL listed for application in air handling systems.
 - 4. Lighting systems shall be moisture resistant with electronic ballasts and shall be wired using moisture resistant conduit.
 - 5. Lighting systems shall be UL rated for use in airstreams with temperatures between 34°F and 170°F, 100% relative humidity and any air velocity.

6. Irradiation – Lamps are to be installed in sufficient quantity and in such a manner so as to provide an equal distribution of the available UV-C energy. When installed, the UV-C energy produced shall be of the lowest possible reflected and shadowed losses and shall be distributed in a 360-degree pattern within the cavity to provide the highest UV-C energy absorption by microbial products in the air.
7. Intensity – The minimal UV-C energy striking a surface shall be sufficient to continuously destroy a mono-layer of mold and/or bacteria in less than one hour while operating in air temperatures of 34°F and 170°F.
8. UV Light fixtures shall be capable of being switched on and off at the respective AHU section access door.
9. Lamps shall be interlocked with access door position limit switches such that they are de-energize when the doors open.
10. Lamps shall be installed on a stainless steel grid using stainless steel fasteners in accordance with the manufacturer's installation instructions.
11. Units equipped with view ports, from which the UVGI lamps can be seen, shall be properly labeled to warn of possible physical harm.
12. Replacement lamps for UV systems shall be standard types which are not proprietary and are available from multiple sources.

2.13 ELECTRICAL PROVISIONS

- A. Fan motors shall be factory mounted and wired to an external disconnect switch within sight of the motor access door. Fan motors shall be interlocked with fan access door to shut down fan when door is opened.
- B. Disconnect switches and starters shall be mounted independent of the unit to allow for maintenance access and access to AHU components. Locate disconnect switches within close proximity and sight of the electrical component. Interlock fan motor starters with a position limit switch located at the fan section access door. The limit switch shall de-energize the fan motor or other electrical components when the access door is opened.
- C. All wiring shall be 600V rated type MTW/THWN #12 stranded copper in EMT or liquid tight conduit (maximum three feet). All junction boxes shall be UL approved and gasketed. All conduits installed on the floor inside air handling units shall be rigid steel with steel fittings and diecast boxes. All EMT conduit and fittings on unit walls and ceiling shall be water tight type.
- D. Provide liquid tight flexible connection to motor; 36-inch maximum length.
- E. Conduit penetrations shall not represent through-metal contact. Penetrations shall be made and sealed before unit factory testing.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations.
- C. Install factory assembled unit on vibration isolators, where fans are not internally isolated. Refer to Section 23 0548.
- D. Install air handling unit(s) level on concrete housekeeping pads.
- E. Install an auxiliary/secondary condensate drain system. Unless otherwise noted, the auxiliary/secondary drain system shall meet the following requirements:
 1. 18 GA., stainless steel, all welded, auxiliary drain pan.
 2. Sides of auxiliary drain pan shall be 2" high (min.) with 1/2" (min.) hem (full-perimeter).
 3. Auxiliary drain pan shall extend 6" beyond all sides of air handling unit(s) and coil piping

connections.

4. Install a water-level detection device or a 1" diameter (min.) condensate drain line to the nearest floor drain. Installation of condensate drain line shall not pose a tripping hazard.
- F. Assemble air handling unit components following manufacturer's instructions for handling, testing and operation. Repair damaged areas with paint in accordance with manufacturer recommendations. Repair painted units by touch up of all scratches with finish paint material. Vacuum and wipe the interior of air handling unit(s) clean prior to operation.
- G. AHU air leakage shall not exceed leakage class (C_L) 12 listed in SMACNA HVAC Air Duct Leakage Test Manual when tested at 1.5 times the design static pressure. Repair casing air leaks that can be heard or felt during normal operation and to meet test requirements.
- H. Perform field mechanical (vibration) balancing in accordance with Section 23 05 48.
- I. Seal and/or fill all openings between the casing and AHU components and utility connections to prevent air leakage or bypass.
- J. Contractor shall furnish and maintain and replace clean pre-filter media in each air handling unit as listed in the equipment schedule on the Drawings during start-up and construction. The Contractor shall install the tagged set of new filter products provided by the air handling unit manufacturer for each unit after it has been tested, commissioned and receives final acceptance by the Owner.
- K. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation of the Owner's representative(s).
- L. Arrange fans and surrounding components in such a way that poor fan performance does not result.
- M. It is the Contractor's responsibility to verify opening dimensions and installation methods to ensure unit sections and components can be physically installed into the designated space.
- N. A certified manufacturer's representative shall supervise reassembling the sections together for all air handlers.
- O. Additional unit section or component splits required for installation during construction shall be the responsibility of the Contractor without additional cost to the Owner.
- P. Units must be bolted together for reassembly. Drive screw construction at unit splits is unacceptable.
- Q. All internal coil piping shall be extended to casing walls.
- R. The unit manufacturer shall provide a written acceptance letter to the Architect stating the unit was assembled and complies with the manufacturer's assembly requirements.

3.02 STARTUP SERVICES

- A. After installation and testing of the air handling unit(s), provide start-up report to the Professional of Record.
- B. An authorized factory representative should start-up, test and certify the final installation and application specific calibration of control components. Items to be verified shall include, but not be limited to, fan performance over entire operating range, noise and vibration testing, verification of proper alignment, overall inspection of the installation, and Owner/Operator training.

END OF SECTION

SECTION 23 8400 FAN-COIL UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes fan-coil units and accessories.

1.03 DEFINITIONS

- A. BAS: Building automation system.

1.04 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling suspension components.
 - 2. Structural members to which fan-coil units will be attached.
 - 3. Method of attaching hangers to building structure.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - 6. Perimeter moldings for exposed or partially exposed cabinets.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification: For each type of fan-coil unit indicated.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For fan-coil units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
 - 1. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.
- H. Warranty: Special warranty specified in this Section.

1.05 QUALITY ASSURANCE

- A. 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.

1.06 COORDINATION

- A. Coordinate layout and installation of fan-coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate size and location of wall sleeves for outdoor-air intake.

1.07 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Compressor failure.
 - b. Condenser coil leak.
 - 2. Warranty Period: 5 years from date of Substantial Completion.

1.08 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fan-Coil-Unit Filters: Furnish 1 spare filter for each filter installed.
 - 2. Fan Belts: Furnish 1 spare fan belt for every unit installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In the Fan-Coil-Unit Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
 - 1. Basis-of-Design Product: The design for each fan-coil unit is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.02 FAN-COIL UNITS

- A. Basis-of-Design Product: Carrier 42C or a comparable product by one of the following:
- B. Available Manufacturers:
 - 1. Carrier
 - 2. Environmental Technologies, Inc.
 - 3. McQuay International.
 - 4. Trane.
 - 5. YORK International Corporation.
 - 6. Johnson Controls
 - 7. Or prior approved equivalent.
- C. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.
- D. Coil Section Insulation: 1/2-inch thick, elastomeric closed-cell foam complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
 - 1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
- E. Main and Auxiliary Drain Pans: Stainless steel formed to slope from all directions to the drain connection as required by ASHRAE 62. Drain pans shall have external insulation.

- F. Chassis: Galvanized steel where exposed to moisture. Floor-mounting units shall have leveling screws.
- G. Cabinet: Steel with baked-enamel finish in manufacturer's standard paint color as selected by Architect.
 - 1. Vertical Unit Front Panels: Removable, steel, with integral stamped discharge grille and channel-formed edges, cam fasteners, and insulation on back of panel.
 - 2. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with integral stamped discharge grilles.
 - 3. Stack Unit Discharge and Return Grille: Aluminum double-deflection discharge grille, and louvered- or panel-type return grille; color as selected by Architect from manufacturer's standard colors. Return grille shall provide maintenance access to fan-coil unit.
 - 4. Steel recessing flanges for recessing fan-coil units into ceiling or wall.
- H. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - 1. Pleated Cotton-Polyester Media: 90 percent arrestance and 6 MERV.
- I. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F . Include manual air vent and drain valve.
- J. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
- K. Fan and Motor Board: Removable.
 - 1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
 - 2. Motor: ECM. Comply with requirements in Division 23 Section "Motors."
 - 3. Wiring Termination: Connect motor to chassis wiring with plug connection.
- L. Factory, Hydronic Piping Package: ASTM B 88, Type L copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.
 - 1. Two-way, modulating control valve for chilled-water coil.
 - 2. Hose Kits: Minimum 400-psig working pressure, and operating temperatures from 33 to 211 deg F . Tag hose kits to equipment designations.
 - a. Length: 36 inches.
 - b. Minimum Diameter: Equal to fan-coil-unit connection size.
 - 3. Automatic Flow-Control Valve: Brass or ferrous-metal body; 300-psig working pressure at 250 deg F, with removable, corrosion-resistant, tamperproof, self-cleaning piston spring; factory set to maintain constant indicated flow with plus or minus 10 percent over differential pressure range of 2 to 80 psig.
 - 4. Y-Pattern Hydronic Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 hose-end, full-port, ball-type blowdown valve in drain connection.
 - 5. Wrought-Copper Unions: ASME B16.22.
 - 6. Risers: ASTM B 88, Type L copper pipe with hose and ball valve for system flushing.
- M. Control devices and operational sequences are specified in Division 23 Sections "HVAC Instrumentation and Controls" and "Sequence of Operation."
- N. Basic Unit Controls:

1. Control voltage transformer.
 2. Unit-mounted thermostat with the following features:
 - a. Heat-cool-off switch.
 - b. Fan on-auto switch.
 - c. Fan-speed switch.
 - d. Automatic changeover.
 - e. Adjustable deadband.
 - f. Concealed set point.
 - g. Concealed indication.
 - h. Degree F indication.
 3. Unit-mounted humidistat.
 - a. Concealed set point.
 - b. Concealed indication.
 4. Unit-mounted temperature sensor.
 5. Unoccupied-period-override push button.
 6. Data entry and access port.
 - a. Input data includes room temperature, and humidity set points and occupied and unoccupied periods.
 - b. Output data includes room temperature and humidity, supply-air temperature, entering-water temperature, operating mode, and status.
- O. DDC Terminal Controller:
1. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
 2. Unoccupied Period Override Operation: Two hours.
 3. Unit Supply-Air Fan Operation:
 - a. Occupied Periods: Fan runs continuously.
 - b. Unoccupied Periods: Fan cycles to maintain room setback temperature.
 4. Hydronic-Cooling-Coil Operation:
 - a. Occupied Periods: Modulate control valve to maintain room temperature.
 - b. Unoccupied Periods: Close control valve.
 5. Heating-Coil Operation:
 - a. Occupied Periods: Energize electric-resistance coil to provide heating if room temperature falls below thermostat set point.
 - b. Unoccupied Periods: Start fan and energize electric-resistance coil if room temperature falls below setback temperature.
 6. Reheat-Coil Operation:
 - a. Occupied Periods:
 - 1) Heating Operations: Energize electric-resistance coil to provide heating if room temperature falls below thermostat set point.
 - 2) Humidity-Control Operations: Humidistat modulates control valve and energizes electric-resistance coil to provide heating. As space temperature rises above the set point, cooling coil valve modulates to maintain room temperature.

- b. Unoccupied Periods: Start fan and energize electric-resistance coil if room temperature falls below setback temperature. Humidity control is not available.
- 7. Controller shall have volatile-memory backup.
- P. BAS Interface Requirements:
 - 1. Interface relay for scheduled operation.
 - 2. Interface relay to provide indication of fault at the central workstation.
 - 3. Provide BACnet interface for central BAS workstation for the following functions:
 - a. Adjust set points.
 - b. Fan-coil-unit start, stop, and operating status.
 - c. Data inquiry, including supply, room-air temperature and humidity.
 - d. Occupied and unoccupied schedules.
- Q. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive fan-coil units for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before fan-coil-unit installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install fan-coil units level and plumb.
- B. Install fan-coil units to comply with NFPA 90A.
- C. Suspend fan-coil units from structure with elastomeric hangers. Vibration isolators are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."
- D. Verify locations of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices between 48 and 60 inches above finished floor.
- E. Install new filters in each fan-coil unit within two weeks after Substantial Completion. These filters shall be in addition to the spare filters to be provided to the Owner.

3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
 - 1. Install piping adjacent to machine to allow service and maintenance.
 - 2. Connect piping to fan-coil-unit factory hydronic piping package. Install factory hydronic piping package if shipped loose.
 - 3. Connect condensate drain to indirect waste.
 - a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.
- B. Connect supply and return ducts to fan-coil units with flexible duct connectors specified in Division 23 Section "Duct Accessories." Comply with safety requirements in UL 1995 for duct connections.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

3.05 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fan-coil units. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION

**SECTION 26 0500
COMMON WORK FOR ELECTRICAL**

PART 1 - GENERAL

1.01 SUMMARY

- A. This section is an extension of the General Requirements (Division 01 of these Specifications) and certain items of a common or administrative nature that pertain to all electrical work.
- B. The work of this section consists of furnishing materials, equipment, constant competent supervision, special tools, test equipment, technicians, and labor necessary for installation of a complete working electrical system as indicated herein and on the Drawings.
- C. The work shall include but not necessarily be limited to the following:
 - 1. Service entrances and mounting of metering equipment as required by the utility company
 - 2. Connections to service from points of termination by utility company
 - 3. Power Distribution Systems: feeder circuits, branch circuits, panels, wiring, transformers, devices, etc.
 - 4. Installation of motor control and variable frequency drive equipment
 - 5. Electrical work incidental to the requirements of the mechanical system.
 - 6. Wiring and connections to equipment furnished and installed under other Divisions of these specifications
 - 7. Raceways and fittings
 - 8. Grounding
 - 9. Lighting System: fixtures, lamps, wiring, connections, etc.
 - 10. Telecommunications System
 - 11. Lighting control system
 - 12. All required sleeves, thimbles, anchors, hangers, bolts, miscellaneous structural steel, cutting, etc., for the complete installation of the electrical systems serving the building
 - 13. Temporary electrical service for construction and maintenance of occupied portions of the building's electrical systems

1.02 SUBMITTALS

- A. Refer to Division 01 - Submittal Procedures for submittal requirements. The following paragraphs are an extension of Division 01 - Submittal Procedures.
- B. Review of shop drawings shall in no way modify the contract or relieve the Contractor from compliance with the contract.
- C. When electronic submittals are allowed, the Contractor shall also provide to the Architect a minimum of 3 hard copies of the submittal for all submittals that are greater than 25 pages or have a single sheet that is larger than 11" by 17".
- D. Names of manufacturers or catalog numbers are listed in the Specification in order to establish a standard for the type, general design and quality of the product required. Where "or approved equal" is indicated, other products similar in design and of equal quality and complying with the Drawings and Specifications will be considered for acceptance. See Division 01 – Substitution Procedures.
- E. Any item not specified herein, but submitted as a substitute for the specified item, shall be submitted in accordance with Division 01 – Substitution Procedures and accompanied by manufacturer's documentation stating/illustrating the following applicable information in addition to the specific information requested in other sections:
 - 1. Dimensions and weight
 - 2. Electrical Ratings: voltage, amperage, short circuit rating, etc.

3. Construction - gauge of steel/aluminum, paint finish/application method, color, NEMA type, etc.
 4. Warranty
 5. Local manufacturer's representative or nearest stocking distributor
 6. Any deviations
- F. Equipment Requiring Submittals: The following items and equipment require submittals for transmittal. Refer to Phasing Plan for scheduling of submittals. No time delays will be allowed for failure to be so informed.
1. Conductors
 2. Cables
 3. Hangers & Supports
 4. Raceway & Boxes
 5. Lighting Controls
 6. Switchgear
 7. Transformers
 8. Switchboards
 9. Panelboards
 10. Wiring Devices
 11. Fuses
 12. Circuit Breakers
 13. Safety Switches
 14. Generators
 15. Inverters
 16. Lightning Protection
 17. SPD
 18. Lighting Fixtures
 19. Telecommunication Cabling
 20. Telecommunication Patch Panels
 21. Fire Alarm System Components
 22. In-slab conduit layout drawing with dimensions
 23. Equipment layout in all Electrical Rooms
- G. Further descriptions or information required with shop drawings shall be included with the description of materials specified herein as follows:
1. Fire Alarm Components: Include shop Drawings showing fire alarm system riser, wiring diagrams and dimensioned Drawings of Fire Alarm Control Panel. Include certification that this Division has fully coordinated all fire alarm system signal and control connections to work of the other Divisions, including but not limited to, automatic temperature controls, fire pump, fire sprinkler system, and elevators.
 2. Housekeeping Pads: Include location and dimensions of housekeeping pads, including blockouts and anchor bolts.
 3. Firestops: Include all firestop materials for the project, indicating intended use and UL fire rating where applicable.
 4. Detailed, dimensioned shop Drawings for the installation of the work in the electrical equipment rooms shall be prepared and submitted for review. These Drawings shall be new Drawings prepared by the Contractor and shall not be reproductions or tracings of

the Drawings. In preparing shop Drawings, establish lines and levels for the work specified and check the Drawings to avoid interference with structural features and the work of other trades. Immediately call to the attention of the Architect in writing any interference for clarification.

5. Detailed, dimensioned shop drawing for the installation of the conduits to be installed in the floor slab. These shop drawings shall be new drawings prepared by the contractor and shall show all conduit rating, locations where conduits are exiting slab. All junction boxes and concrete rings shall have dimensioned locations. Coordinate conduit "turn-up" or turn downs" with architect. Drawings to insure all conduits will be concealed either in the slab or in the walls.
- H. Corrections or comments made on shop Drawings during the review do not relieve the Contractor from compliance with requirements of the contract documents. Shop Drawings will be checked for general conformance with the design concept of the project and general compliance with information given in the contract documents.
- I. Review of the shop Drawings shall not relieve the Contractor from responsibility for confirming and correlating all quantities and dimensions, coordinating work with that of all other trades, and performing work in a safe and satisfactory manner. Review of shop Drawings shall not permit any deviation from Drawings and Specifications. Shop Drawings must be accompanied by signed statement from contractor, stating that he has reviewed the submittal and checked it for compliance.
- J. The following submittals shall be submitted together:
 1. Hangers & Supports and Raceways & Boxes together
 2. Panelboards, Enclosed Switches & Circuit Breakers, Transformers, and Surge Protection Devices together
- K. Panelboard and switchboard submittals shall be submitted after the major mechanical equipment submittals have been submitted such that general coordination between Divisions can be verified.

1.03 QUALITY ASSURANCE

- A. The electrical installation shall conform to the requirements of the 2020 edition of the National Electrical Code (NEC). Notify Architect of any conflicts prior to installation.
- B. Electrical material shall be built and tested in accordance with the applicable standards of the National Electrical Manufacturers' Association (NEMA), the American National Standards Institute (ANSI) the American Society for Testing and Materials (ASTM), and the Institute of Electrical and Electronic Engineers (IEEE)
- C. Electrical materials shall be new and unused and shall be listed and labeled for the service intended by Underwriters' Laboratories, Inc., where such labeling service is available.
- D. Applicable sections of the following codes and standards shall also be followed:
 1. NFPA - National Fire Protection Association including NFPA-101, Life Safety Code.
 2. OSHA Code of Federal Regulations
 3. IBC - International Building Code as adopted by the local authority having jurisdiction.
 4. Applicable state and local codes and ordinances
 5. ETL - Electrical Testing Laboratories
 6. IES - Illuminating Engineering Society
 7. NECA – National Electrical Contractors Association
 8. UL – Underwriters Laboratories
- E. Include all items of labor and materials required to comply with the above referenced codes and standards. Where quantities, sizes, or other requirements indicated on Drawings or herein specified are in excess of the requirements of the standards and codes, the Specifications or Drawings shall govern.

1.04 REGULATORY REQUIREMENTS

- A. Permits: Obtain and pay for all necessary permits, inspections, connection charges, fees, insurance, bond, licenses, and comply with all governing laws, ordinances, rules and regulations including those of the NFPA and all municipal, state or other authority having jurisdiction over the work.
- B. Certificates of Inspection: Upon completion and before the date of substantial completion of each designated Phase, furnish a certificate of inspection issued by the proper authorities to the effect that the installation is in full conformity with all local and state requirements.

1.05 COORDINATION

- A. Contact the electrical utility for all requirements associated with the electrical service and electrical metering. All bidders are responsible for to insure the latest utility installation standards are met.
- B. Layout the work and be responsible for its correctness. Take such measurements as may be necessary to assure approved fitting and proper installation of work, and all other work depending thereon.
- C. Arrange work in a neat, well organized manner with exposed conduit and similar services running parallel with primary lines of the building construction, high as possible with a minimum of 8'-0" overhead clearance or as directed by the Architect.
- D. Perform all work in the best and most substantial manner by workmen skilled in the work to be done. Provide adequate supervision at all times.
- E. Cooperate with other contractors to avoid complications between the installation of the various items of equipment. Advise other trades of openings required in their work for the subsequent move-in of large units of electrical equipment.
- F. Locate operating and control equipment properly to provide easy access, and arrange entire electrical work with adequate access for operation and maintenance.
- G. Where the method of installation is not certain, ask for details. Lack of details, not requested, will not be an excuse for improper installation, and any such work must be corrected.
- H. Coordination Drawings: For locations where several elements of electrical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings showing the actual physical dimensions (at accurate scale, minimum 1/4") required for the installation. Prepare and submit coordination drawings prior to purchase-fabrication-installation of any of the elements involved in the coordination.
- I. All Bidders shall be responsible to insure that equipment selected: switchboards, panelboards, etc., fit in spaces selected, and meet all NEC 110.26 requirements. If standard equipment does not fit, Contractor shall be required to utilize custom equipment as required.

1.06 DRAWINGS AND SPECIFICATIONS

- A. Contract Documents (Drawings and Specifications) are intended to convey the scope of work and indicate general arrangements of equipment, fixtures and piping, and approximate sizes and locations of equipment and outlets. Follow these documents in laying out the work, check all Drawings to become familiar with all conditions affecting the work, and verify spaces in which the work will be installed.
- B. The contract documents are diagrammatic in showing certain but not all, physical relationships which must be established within the electrical work. Its interface with other work including plumbing, fire protection and mechanical work is the exclusive responsibility of the Contractor.
- C. The Drawings show approximate locations only of selected feeders, branch circuits, outlets, etc., except where specific routing or dimensions are indicated. The Architect reserves the right to make reasonable changes in locations indicated before roughing-in without additional cost to the Owner. The Contractor, at a minimum, should allow all feeders, branch circuits, and outlets shown to be relocated 10 feet in any direction without additional cost to the Owner.

- D. Because of the small scale of the Drawings, it is not possible to indicate all of the offsets, fittings, and accessories required. Contractor shall investigate the structural and finish conditions affecting Division 26, Electrical work and shall arrange such work accordingly, furnishing fittings, bends, junction boxes, pull boxes, access panels, and accessories required to meet such conditions.
- E. These Specifications, together with the accompanying Drawings, contemplate apparatus fully erected, and in satisfactory operating condition with the Contractor furnishing and installing everything that may be necessary to complete the job.

1.07 PROJECT/SITE CONDITIONS

- A. Visit the site before bidding to become familiar with conditions under which the work will be performed.
- B. No additional compensation will be allowed for failure to be so informed.

1.08 RECORD DRAWINGS

- A. Prepare Record Drawings in accordance with the requirements in Division 01 - Closeout Procedures. The following paragraphs are in addition to Division 01 - Closeout Procedures.
- B. In addition to the requirements specified in Division 01 - Closeout Procedures, indicate the following installed conditions:
 - 1. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 2. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
 - 3. Contract Modification, actual equipment and materials installed.
 - 4. Complete As-Built Drawings of Division 26, Electrical work shown and not shown on the contract drawings in the new and existing facilities.
- C. Equipment Manuals:
 - 1. Before the date of substantial completion, Contractor shall furnish to the Architect three (3) bound sets of descriptive, dimensional and parts data on all major items of electrical equipment and material including those items listed above under "Shop Drawings:".
 - 2. Each set of this literature shall be bound in a permanent type hard cover ring binder and shall be suitably indexed.
 - 3. This submittal shall be accompanied by final Electrical Inspection Certificate from the authority having jurisdiction and Statement of Inspection from State Fire Marshal's Office.

1.09 WARRANTY

- A. Except where longer periods of warranty are specified, guarantee all labor and materials for a period of twelve (12) months from the date of substantial completion of the particular phase of the work. Repair all defective materials and work; replace with new materials and/or equipment, any material and/or equipment failing to give satisfactory service.
- B. During the period of guarantee, promptly correct any defects in equipment, materials or workmanship without cost to the Owner.
- C. Guarantee includes equipment capacity and performance ratings specified without excessive noise levels. Any deficiencies in equipment specified shall be promptly corrected.
- D. Contractor's warranty shall include an inspection of the system one (1) week before the end of the one (1) year warranty period. Replace or repair any items found to be defective at this time.

1.10 TESTS AND BALANCING

- A. At such times as the Architect directs, conduct operating tests to demonstrate that the electrical systems are installed and will operate properly and in accordance with the requirements of this Specification. Tests shall be performed in the presence of the Architect's representative. Furnish instruments and personnel required for such tests.

- B. All power and lighting loads shall be tested by Contractor prior to final approval.
- C. Any work and materials tested and found varying from the requirements of the Drawings and Specifications shall be replaced without additional cost to the Owner.
- D. This section does not relieve the Contractor from testing equipment installed under this Division but not listed in this section. Contractor is required to test all equipment, feeders, etc., installed under this Division.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Refer to Division 01 sections for general requirements on products, materials and equipment. The provisions outlined below expand or modify the requirements as applicable to electrical work. Refer to other Division 26, Electrical sections for additional requirements.
- B. Materials and equipment shall conform in all respects to the requirements set forth in these Specifications and the accompanying Drawings.
- C. Provide products which are compatible with other products of the electrical work, and with other work requiring interface with the electrical work, including electrical connections and control devices. For exposed electrical work, coordinate colors and finishes with the Architect and as referenced in Section 09 91 23. Determine in advance of purchase that equipment and materials proposed for installation will fit into the confines indicated, leaving adequate clearance as required by applicable codes, and for adjustment, repair, or replacement.

2.02 FIREPROOFING:

- A. Where conduit and/or cables penetrate fire-resistant/rated walls, partitions, ceilings, or floors, adequate fire seals using approved UL methods to maintain the fire-resistance rating shall be provided and installed in accordance with Division 07, Section "Firestopping".
- B. Approved methods constitute providing a minimum of one-inch (1") depth of Scotch Putty 303 or Caulk CP25.3 surrounding metal conduit penetrations. Larger square or circular penetrations shall require construction of fire-rated barrier utilizing Scotch Series 7903/7904 barrier sheets.
- C. Plastic sleeves/pipe shall not be used within the building when penetrating a fire-resistant-rated wall, ceiling, partition, or floor.
- D. All fire proofing to be certified.

2.03 INSERTS AND THIMBLES

- A. Set in place as form work progresses, all necessary inserts and thimbles as may be required. Cutting of beams or of concrete floors or walls will not be permitted.
- B. All thimbles set in concrete shall be of standard pipe, plain ends, and shall be of proper size to allow for freedom around piping passing through thimble.
- C. Thimbles set in the walls, partitions or in chases where structural requirements will allow, shall be of rigid galvanized steel conduit.
- D. Inserts shall be nailed to form work and shall be of size to allow for installation of hangers for the particular pipe served.

2.04 MANUFACTURERS' NAMEPLATES

- A. Each major component of the equipment shall have the manufacturer's name, address, model number, and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. NEMA Code ratings, or other data which are die-stamped into the surface of the equipment shall be stamped in an easily visible location.

PART 3 - EXECUTION

3.01 GENERAL

- A. Visit the building site before bidding to determine existing conditions and assume all responsibility and bear all expenses in allowing for these conditions in the bid.

- B. Contact the utility and receive approval in writing before installing any work associated with the electrical service and electrical metering, including, but not limited to pole, grounding, and concrete pad requirements.
- C. No work shall be concealed until approved by the local inspector and all local regulations are adhered to.
- D. Upon completion, a certificate of approval from the appropriate regulatory agency shall be furnished to the Architect.
- E. Study all sections of the Specifications and Drawings. Notify Architect of conflict between Drawings and Specifications before bidding.
- F. Electrical Drawings are diagrammatic except where dimensioned. Do not scale. Follow manufacturers certified shop drawings for accuracy. Unless noted as fixed, dimensions are based on the product of one (1) manufacturer. Verify dimensions with certified shop Drawings of the materials actually approved and purchased.

3.02 PROTECTION OF APPARATUS

- A. At all times the Contractor shall take precautions necessary to protect his apparatus from damage. Failure on the part of the Contractor to comply with the above to the Architect's satisfaction shall be sufficient cause for the rejection of the particular piece of apparatus in question.

3.03 CUTTING AND PATCHING

- A. Do all cutting, fitting, and all other work that may be required to make the several parts come together and fit. Cutting for equipment entry shall be under other Divisions. Do not endanger any work by cutting, digging, or otherwise, and do not cut or alter the work of any other Divisions, except with the consent of the Architect. Cutting shall be done under the supervision of the Project Superintendent. Patching, including patching of bonded roofing, shall be performed under Division 02.
- B. Provide, properly located and sized, all required chases, shafts, openings, furred spaces, etc., required for the work or to conceal any of the work, in any part of the structure.
- C. It is the responsibility of this Division to coordinate with other responsible Divisions for required cutting and patching.

3.04 TEMPORARY WIRING, LIGHTING AND POWER AT THE SITE

- A. Furnish and install provisions for temporary electrical service and construction light and power during the construction period conforming to the contract documents, all local code and State labor law requirements.
- B. Arrange for temporary service with the Utility Company.
- C. Furnish, install, and maintain all temporary service equipment as required until permanent service is installed switch-over of temporary systems on the permanent service when latter is ready for same.
- D. Furnish, install, maintain, and switch on and off on all regular work days a complete temporary light system, for the building while under construction.
- E. Provide any and/or all relocations of temporary electric facilities as necessary to clear the permanent installations of all trades.

3.05 WIRING FOR EQUIPMENT BY OTHERS

- A. Electrical service for all equipment furnished under this Specification and/or indicated on the Drawings shall be roughed-in and connected under this Section. It is the responsibility of the Contractor to obtain correct roughing-in dimensions and requirements for this equipment.
- B. Raceways, outlets, backboards, cabinets, grounding connections, handholes, underground distribution system, and other roughing-in indicated shall be provided as work of this division for telephone system, security system and data system.

3.06 MECHANICAL EQUIPMENT

- A. All power wiring associated with Division 21, Fire Suppression, Division 22, Plumbing, and/or Division 23, HVAC shall be done as work under Division 26, Electrical. All power disconnect switches and single speed manual starting switches shall be furnished and installed under Division 26. Multi-speed manual starters, magnetic starters, variable frequency drives shall be furnished under Division 21, Fire Suppression, Division 22, Plumbing, and/or Division 23, HVAC and installed under Division 26, Electrical.
- B. Except as may be indicated on the Drawings and/or hereinafter noted, all control wiring, including all temperature control wiring, interlocking, start-stop wiring, shall be furnished and installed under Division 21, Fire Suppression, Division 22, Plumbing, and/or Division 23, HVAC. This includes, but is not limited to, wiring to low voltage thermostats, damper motors, aquastats, firestats, pushbuttons, selector switches, and control panel(s). All disconnect switches for control shall be furnished and installed under Division 21, Fire Suppression, Division 22, Plumbing, and/or Division 23, HVAC. Wiring, conduit, and control shall meet the requirements of Division 26, Electrical.
- C. Work of other divisions will include furnishing and setting motors.
- D. All magnetic starters and variable frequency drives will be furnished under Division 26, Electrical, except for packaged equipment that will be furnished under another division of the Specifications. Overload elements in all starters shall be selected according to actual motor nameplate full load current. Responsibility for this coordination shall lie with the division under which the particular starter was furnished.
- E. Firestats for single phase exhaust fans with manual starting switches and wall mounted thermostats which interrupt line voltage power circuits to motors shall be furnished and set under Division 21, Fire Suppression, Division 22, Plumbing, and/or Division 23, HVAC, and electrically connected in the branch circuit wiring as work of Division 26, Electrical.

3.07 WORKMANSHIP

- A. Install all materials and electrical components of the work in accordance with instructions of manufacturer following the best modern construction practices and conforming with the Contract Documents. Workmanship shall be first class, in both function and appearance, whether finally concealed or exposed and shall be performed by experienced workmen skilled in the type of work.
- B. As practicable, the lines of all components of the system shall be perpendicular or parallel. In general, workmanship shall conform to guidelines set forth in N.E.C.A. manuals.

3.08 CLEANING UP

- A. Remove once per week and at the completion of the work all empty cartons, scrap wire, raceways, rubbish, etc., accumulated on the project as a result of work performed.
- B. Remove all marks, stains, fingerprints, bugs, dust and other foreign material from all electrical components. Refinish damaged surfaces and restore original finish to the satisfaction of the Architect.

3.09 CONTRACTOR OPERATIONAL TESTING

- A. Contractor shall verify proper operation of systems prior to Owner acceptance testing and prior to substantial completion.

3.10 SAFETY

- A. It shall be the Contractor's responsibility to do all things necessary in the pursuit of the installation or testing to provide safe conditions in which to work.

END OF SECTION

SECTION 26 0501
ELECTRICAL RELATED WORK

PART 1 - GENERAL

1.01 SUMMARY

- A. Extent of electrical related work required by this section is indicated on Drawings and/or specified in other Division 26, Electrical sections.
- B. Types of electrical related work specified in this section include the following:
 - 1. Access to Electrical Work: Removable cover plate in walls, ceiling and floors
 - 2. Excavating, Trenching and Backfill for Electrical Work
 - 3. Foundations and Supports
 - 4. Cutting and patching
 - 5. Concrete for Electrical Work:
 - a. Encasement of electrical work
 - b. Underground structural concrete to accommodate electrical work
 - c. Electrical equipment foundations and mounting pads
 - d. Rough grouting in and around electrical work
 - e. Patching concrete which has been cut to accommodate electrical work

1.02 PROJECT/SITE CONDITIONS

- A. Protect property from damage which might result from excavating and backfilling.
- B. Protect persons from injury at excavations by barricades, warnings and illumination.
- C. Coordinate excavations with weather conditions, to minimize possibility of washouts, settlements and other damages and hazards.

1.03 ACCESS TO ELECTRICAL WORK

- A. Access Doors: General: Where floors, walls and ceilings must be penetrated for access to electrical work, provide types of access doors indicated by project conditions, including floor doors if any. Furnish sizes indicated or, where not otherwise indicated by project conditions, furnish adequate size for intended and necessary access. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, completes with anchorages and hardware.
- B. Access Door Construction: Except as otherwise indicated, fabricate wall/ceiling door units of welded steel construction with welds ground smooth; 16-gage frames and 14-gage flush panel doors, 175 degree swing with concealed spring hinges; flush screw-driver-operated cam locks; factory-applied rust-inhibitive prime-coat paint finish.
- C. Removable Access Plates: General: Where switches, control devices, pull boxes, and similar elements of electrical work are located within or behind wall or ceiling construction of finishes, or below grade, and are not (cannot be) provided with integral removable access plates as specified in other Division-26 Electrical, sections, provide removable access plates of types and sizes needed for access requirements. Provide manufacturer's complete units with anchorages, fasteners, and standard factory-applied finishes.
- D. Wall/Ceiling Unit Construction: Except as otherwise indicated, and where adaptable to substrate, provide manufacturer's standard frameless round formed stainless steel or chrome-plated brass low-profile plate cover, with single exposed flush screw anchor, with bright polished finish.
- E. Units Set at Grade: Except as otherwise indicated, provide manufacturer's standard round or square cast-iron units, complete with cast-iron pipe extension to protect electrical elements being accessed; designed to be set slightly above finish grade, and to be encased in concrete; secure plate to body with bronze screws; natural mill finish on plate and body.

1.04 EXCAVATING FOR ELECTRICAL WORK

- A. Backfill Materials: Refer to Division 31 Section, Earth Moving.
- B. Materials of Concrete Work: Refer to Division 03 Section, Concrete.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.01 EXCAVATION, TRENCHING AND BACKFILLING

- A. Perform all excavation of every description and of whatever substances encountered to the depths indicated on the Drawings or as otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or not suitable for backfill shall be removed and wasted or removed from jobsite as indicated on the Drawings or as directed by Architect at no additional cost to Owner.
- B. Sheet piling and shoring shall be done as necessary for the protection of the work and for the safety of personnel. Provide necessary pumping and/or well pointing at all times to maintain a dry working condition in all trenches. Unless otherwise indicated, excavations shall be by open cut except that short sections of a trench may be tunneled if, in the opinion of the Architect the conduit can be safely and properly installed and backfill can be properly tamped in such tunneled sections.
- C. No excavation or trenches shall be cut near or under footings without first consulting Architect.
- D. Where open cut excavations/trenches are near tree root system, consult architect for directions prior to excavation. Contractor shall ultimately be responsible for installations of conduits by methods best suited to preserve tree root systems as per architect directions.
- E. Bottom of trench shall be shaped to give substantially uniform circumferential support to lower third of each pipe. Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with adjoining pipe and to prevent sudden offset to flow line. As work progresses, interior of pipe shall be cleared of dirt and superfluous materials of every description.
- F. Wherever wet or otherwise unstable soil that is incapable of properly supporting the pipe, as determined by the Architect is encountered in the bottom of the trench, such soil shall be removed to the depth required and the trench backfilled to the proper grade with coarse sand, fine gravel, or other suitable material, and approved by the Architect.
- G. Trenches for utilities shall be of a depth that will provide the following minimum depth of cover from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown:
 - 1. 30-inch minimum cover - electrical conduits/cables over 600 volts
 - 2. 24-inch minimum cover - electrical cables/conduits under 600 volts
- H. Backfill shall be installed in layers 6" deep, adequately wetted and tamped using materials as noted above. The surface shall be graded to a reasonable uniformity and the mounding over trenches left in a uniform and neat condition as approved by the Architect. Refer to plans for compaction densities.
- I. Restore all hard finished surfaces such as roadways, sidewalks, grass, shrubbery, etc., removed for installation of utilities (and not shown on Drawings or specified to be reworked under other sections of the work) to their original condition using the same type as original materials. Patching concrete roadways shall require doweling to tie-in matching reinforcement rods or highway mesh to existing roadway. Doweling shall occur every 18 inches on both sides of the trench. Restore to near original condition acceptable to Architect.
- J. Carefully plan all work to avoid existing utilities and other interferences. The Drawings do not indicate all existing underground utilities. Existing utility lines to be retained that are shown on the Drawings or the locations of which are made known to the Contractor prior to excavation, as well as all utility lines uncovered during excavation operations, shall be protected from damage

during excavation and backfilling and, if damaged, shall be repaired by Contractor at his expense. Prior to doing any excavation with power tools, carefully investigate and locate any exiting conduit, pipes, and other lines.

- K. Install access units in accordance with manufacturer's written instructions, in compliance with NEC and recognized industry practices.
- L. Coordinate with other work, including substrate construction work, as necessary to interface installation of access units with other work.
- M. Locate each removable access unit accurately in relation to electrical work requiring access.
- N. Provide adequate temporary support or attachment to framing or form work so that units will not be dislocated during construction of substrates. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.
- O. Adjust hardware and panels after installation for proper operation.
- P. Remove and replace panels or frames, which are warped, bowed or damaged.

3.02 PAINTING

- A. Factory painted equipment shall have finish restored to Manufacturer's finish if scratched or damaged before acceptance or use by Owner.

END OF SECTION

SECTION 26 0519
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes wires, cables, and connectors for power, lighting, signal, control and related systems rated 600 volts and less.
- B. Related Sections include the following:
 - 1. Section 26 05 26 – Grounding & Bonding
 - 2. Section 26 05 29 – Hangars & Supports for Electrical Systems
 - 3. Section 26 05 33 – Raceways & Boxes for Electrical Systems

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with provisions of the NEC.
- B. Conform to applicable Codes and regulations regarding toxicity of combustion products of insulating materials.
- C. UL Compliance: Provide components which are listed and labeled by UL under the following standards.
 - 1. UL 4
 - 2. UL 83
 - 3. UL 486
- D. NEMA/ICEA Compliance: Provide components which comply with the following standards:
 - 1. WC-5 Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy IEEE Compliance: Provide components which comply with the following standard.
 - 2. Std. 82 Test procedures for Impulse Voltage Tests on Insulated Conductors.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cable according to NEMA WC-26

1.05 COORDINATION

- A. Coordinate layout and installation of cable with other installations. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. General: Provide wire and cable suitable for the temperature, conditions and location where indicated.
- B. Conductors: Provide stranded conductors for power and lighting circuits #12 AWG minimum size. Provide stranded conductors for size #14 AWG for control circuits.
- C. Multi-conductor Cable: Comply with NEMA WC 70 for Metal-Clad, Type MC, with ground wire. Interlocking Aluminum Strip Armor with polypropylene tape assembly covering. Meets UL 83, 1479 1569, and 1581.
- D. Conductor Material: copper for all wires and cables.
- E. Aluminum conductors shall not be used.
- F. Insulation: Provide 600 volt THHN/THWN insulation for all conductors unless otherwise noted.
- G. Color Coding for phase identification in accordance with Table 1 in Part 3 below.

- H. Jackets: Factory-applied nylon or PVC external jacketed wires and cables for pulls in raceways over 100-feet in length, for pulls in raceways with more than three equivalent 90 deg. bends, for pulls in conduits underground or under slabs on grade, and where indicated.
- I. Cables: Provide the following type(s) of cables in NEC approved locations and applications where indicated. Provide cable UL listed for particular application:
 - 1. Armored Cable.
 - 2. Factory manufactured and listed fixture whips.

2.02 ACCESSORIES

- A. Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.
- B. For conductors larger than #6 AWG use compression type connectors only for splices and terminations to equipment where possible.
- C. At cable size transition splices use compression connectors, with bolted connection if necessary. Use bolted compression or tee connections where the number of connections exceed two.
- D. Split bolts and mechanical connectors may only be used if a compression method is not feasible.
- E. Push-in wire connector shall not be used.

PART 3 - EXECUTION

3.01 APPLICATIONS

- A. Service Entrance: Type THWN, copper conductor, in raceway.
- B. Feeder and Branch Circuits: Type THHN/THWN, copper conductor, in raceway.
- C. Class 1 Control Circuits: Type THHN/THWN, copper conductor in raceway.
- D. Class 2 Control Circuits: Type THHN/THWN, copper conductor in raceway.
- E. MC Cable may be installed in the following conditions:
 - 1. Connections to light fixtures in lay-in ceilings. Minimum inside diameter shall be 1/2".
 - 2. For all recessed and semi-recessed lighting fixtures in lay in ceilings, the cable shall be long enough to allow fixtures to be moved one ceiling grid space in any direction.
 - 3. Between devices on the same circuit with a maximum length of 40'.

3.02 INSTALLATION

- A. Install all power wire in raceway as indicated in Section 26 05 33.
- B. General: Install electrical cables, wires, and connectors in compliance with NEC.
- C. Coordinate cable installation with other Work.
- D. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.
- E. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.
- F. Conceal all cable in finished spaces.
- G. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours, where possible.
- H. Keep conductor splices to minimum.
- I. TAPS and splices of #6 AWG and larger shall use compression bolted connectors. Splices in #8 AWG and smaller shall be made using preinsulated wing-nut spring tension connectors manufactured by 3-M Scotch, Ideal, or approved equal.

- J. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced.
- K. Use splice and tap connectors which are compatible with conductor material.
- L. Provide adequate length of conductors within electrical enclosures and train the conductors in terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.
- M. Wiring at Outlets: Install with at least 9 inches of slack conductor at each outlet.
- N. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torque's specified in UL 486A and UL 486B.
- O. Minimum size power and lighting wiring shall be #12 AWG.
- P. Motor control circuits may be #14 AWG.
- Q. Use #10 AWG conductor for 20 amp. 120 volt branch circuit home runs longer than 100 ft., and for a 277 volt branch circuit home runs longer than 200 ft.
- R. Conductor derating: Derate conductor ampacity in accordance with NEC raceway fill requirements. Do not fill raceways so that conductor derating will exceed 50 percent. Harmonic loading shall be considered for circuits serving office and/or classroom spaces.
- S. Power Branch circuit neutrals: Provide separate grounded conductor (neutral) for each receptacle circuit 15 and/or 20 amps, that serves office and/or classroom spaces. Harmonic's shall be assumed in these areas.
- T. Power branch circuits for receptacles in mechanical spaces, rooftop, outside convenience outlets, and other similar locations may use shared grounded conductors.
- U. Identify phases on at all termination and splice points, by a following method and as required by the NEC:
 - 1. For conductors #6 AWG and larger use color tape, at least 4 inches at each required location.
 - 2. For conductors smaller than #6 AWG, marking shall be completed with continuous insulation color. These conductors shall not be color taped.

3.03 FIELD QUALITY CONTROL

- A. Prior to energizing, check installed wires and cables with mega-ohm meter to determine insulation resistance levels to assure requirements are fulfilled.
- B. Prior to energizing, test wires and cables for electrical continuity and for short-circuits.
- C. Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.
- D. Color code secondary service, feeder, and branch circuit conductors with factory applied color as follows:

<u>208Y/120 Volts</u>	<u>Phase</u>	<u>480Y/277 Volts</u>
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray
Green	Ground	Green
Green with Yellow Stripe	Isolated Ground	

END OF SECTION

**SECTION 26 0526
GROUNDING & BONDING**

PART 1 - GENERAL

1.01 SUMMARY

- A. The work of this section consists of providing labor, materials, tools, appliances and miscellaneous accessories associated with grounding of the electrical system as required by and as is indicated herein and/or on the Drawings.

1.02 SCOPE OF WORK

- A. Main electric service equipment, raceways, motors, panelboards and other electrical equipment shall be effectively and permanently grounded to a grounding electrode. This electrode shall be the nearest available effectively grounded structural metal member of the structure or the nearest available effectively grounded metal water pipe and also a driven rod. Grounding connections and conductor sizes shall be in accordance with requirements of the NEC, Article 250, and local ordinances, and as described herein.
- B. A separate grounding conductor, sized in accordance with NEC shall be provided in the conduit with the circuit conductors for all feeder and branch circuits. The grounding conductor may be bare or insulated copper; however, if this conductor is insulated, the insulating covering shall be a green color. Conduit runs shall be increased in size where necessary to accommodate the grounding conductor in addition to circuit conductors. The electrical continuity of all conduit runs shall be verified and corrected where necessary.
- C. Isolated Ground Connectors shall be insulated. Additional grounding conductors and conduit shall be provided as specified herein or shown on the drawings. All conduit for grounding system conductors, not run in conduit with circuit conductors, shall be rigid steel conduit.
- D. All electrical equipment enclosures and conductor enclosures shall be grounded. This includes but is not limited to metal raceways, outlet boxes, cabinets, switch boxes, motor frames, transformer cases and metallic enclosure for all electrical equipment.
- E. Under no circumstances shall neutral conductors again be grounded after they have been grounded once at the transformer secondary.
- F. Panelboards shall be equipped with a neutral bar which is insulated from the enclosure, and a grounding bar which is bonded to the enclosure. The grounding bar shall provide for terminating the green equipment grounding conductors in the panelboard or motor control center cabinets. The grounding bar shall be bonded to the cabinet. Neutral busses shall be isolated from ground except at the transformer ground connection.
- G. Types of grounding in this section include the following:
 - 1. Underground metal water piping
 - 2. Grounding electrodes
 - 3. Service equipment
 - 4. Enclosures
 - 5. Systems
 - 6. Equipment
- H. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.
- I. Provide Bonding Jumper across water meter.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

- A. General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated, with assembly of materials including, but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes, bonding jumper braid, surge

arrestors and other items and accessories needed for complete installation. Where more than one type meets indicated requirements, selection is Installer's option. Where materials or components are not otherwise indicated, comply with NEC, UL and IEEE requirements and with established industry standards for applications indicated.

- B. Bonding Jumper Braid: Copper braided tape, constructed of 30-gage bare copper wires and properly sized for indicated applications.
- C. Flexible Jumper Strap: Flexible flat conductor, 480 strands of 30-gage bare copper wire, 3/4" wide, 9-1/2" long, 48, 250 CM. Protect braid with copper bolt hole ends with holes sized for 3/8" dia. bolts.
- D. Grounding Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC.
- E. Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors terminals and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.
- F. Ground Electrodes: Ground Rods: Steel with copper clad welded exterior, 5/8" dia. X 10'. Copper flashed rods shall not be used.
- G. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, solder, soldering flux, bonding straps, as recommended by accessories manufacturers for type services indicated.
- H. Field Welding: Comply with AWS code for procedures, appearance, and quality of welds and methods used in connecting welding work. Provide welded connections where grounding conductors connect to underground grounding rods/electrodes.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure grounding and ground-fault protection devices comply with requirements. Comply with requirements of NEC, and NECA's "Standard of Installation".
- B. Coordinate with other electrical work as necessary to interface installation of grounding system and ground fault protection devices with other work.
- C. Cadweld grounding conductors to underground grounding electrodes. The building equipment grounding system shall consist of the ground wire, and electrically continuous metallic conduit system. Every item of equipment served by the electrical system shall be bonded to the building equipment ground.
- D. Portions of metallic piping and duct systems which are electrically isolated shall be bonded to the equipment grounding system with a flexible bonding jumper.
- E. The neutral shall be grounded to the grounding electrode system at the service entrance only, and shall be kept isolated from the building grounding system throughout the building. The neutral of separately derived systems shall be grounded at one point.
- F. Provide bonding and grounding wires run in conduit and sized per the NEC in accordance with the local electrical inspection department and the NEC. Metallic piping and duct systems which enter the building shall be grounded at the point of entry to the building, in accordance with the NEC.
- G. Continuity of the building equipment grounding system shall be maintained throughout the project. Grounding jumpers shall be installed across conduit expansion fittings, all liquid-tight flexible metal and flexible metal conduit, light fixture pigtails in excess of 6', and all other nonelectrically continuous raceway fittings.
- H. All main grounding conductors shall be stranded copper conductors, sized as shown and/or required, and run in a suitable raceway. All main grounding conductors shall be continuous without joints or splices over their entire length.

- I. Bond the case and neutral of each transformer directly to the nearest available effectively grounded structural metal member of the structure, the nearest available effectively grounded metal water pipe, or in accordance with the local electrical inspection department. Flexible conduit shall not be used as a ground path to a transformer.
- J. Provide a #6 ground conductor from the telephone service equipment to the building grounding system as required by the local Telephone Company.
- K. Carefully and securely ground all fluorescent fixture bodies to the conduit grounding system. Flexible conduit longer than 6' shall not be considered a ground path.
- L. Ground all grounding-type receptacles with a separate ground wire.
- M. Grounding of all motors or equipment connected to terminal box with flexible conduit shall be made with separate grounding conductor between motor frame or equipment cabinet and rigid conduit system. Grounding conductor shall be sized in accordance with NEC Table 250.122.
- N. All grounding conductors shall be amply protected from mechanical injury and shall be supported in an approved manner. Where conductors are located in concrete, they shall be installed in conduit. Where ground conductors enter or emerge from slabs bearing directly on fill or soil, the voids between the conductor and surrounding conduit shall be filled with compound to provide an effective water seal.
- O. Grounding conductors shall be not smaller than #12 AWG. Conductors shall be high conductivity copper, and sizes larger than #10 AWG shall be stranded.
- P. Insulated bushings shall be installed on all raceways at transformers, switchboards, motor-control centers, dry-type transformers, as well as switches used as service equipment.
- Q. Install braided type bonding jumpers with clamps on water meter piping to electrically bypass water meter.
- R. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.
- S. For all motor circuit and all circuits serving multi-outlet assemblies provide a separate grounding conductor in addition to any conduit ground. Conduit runs shall be increased in size where necessary to accommodate the grounding conductor in addition to circuit conductors.

3.02 FIELD QUALITY CONTROL

- A. Upon completion of installation of electrical grounding system, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over 3 ohms, take appropriate action to reduce resistance to 3 ohms or less by driving additional ground rods and/or by chemically treating soil encircling ground rods with sodium chloride, calcium chloride, copper sulphate, or magnesium. Then retest to demonstrate compliance.

END OF SECTION

SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for requirements for miscellaneous metal items involved in supports and fastenings.
 - 2. Division 07 Section "Joint Sealants" for requirements for fire stopping at sleeves through walls and floors that are fire barriers.
 - 3. Section 26 05 00 – Common Work for Electrical

1.02 SUBMITTALS

- A. Product data for each type of product specified.
- B. Hanger and support schedule showing manufacturer's figure number, size, spacing, features, and applications for each required type of support, hanger, sleeve, seal, and fastener to be used.

1.03 QUALITY ASSURANCE

- A. Electrical Component Standard: Component and installation shall comply with NEC & NECA "Standard For Installation"
- B. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third party certification follow-up services.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

- A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps
- B. Fasteners: Types, materials, and construction features as follows:
- C. Expansion Anchors: Carbon steel wedge or sleeve type.
- D. Toggle Bolts: All steel springhead type.
- E. Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.
- F. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.
- G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.
- H. U-Channel Systems: 16-gage steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

2.02 FABRICATION

- A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

- B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.
- C. Pipe Sleeves: Provide pipe sleeves of one of the following:
- D. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:
 - 1. < 4": 20-gage
 - 2. 4" to 6": 16-gage
 - 3. > 6": 14-gage
 - 4. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe
 - 5. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe

2.03 FINISHES

- A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install supporting devices to fasten electric components securely and permanently in accordance with NEC requirements, NECA 1, NECA 101, and with support manufacturer instructions.
- B. Coordinate with the building structural system and with other electrical installation.
- C. Tie-wraps shall not be used.
- D. Raceway Supports: Comply with the NEC and the following requirements:
 - 1. Conform to manufacturer's recommendations for selection and installation of supports.
 - 2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.
 - 3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
 - 4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
 - 5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
 - 6. Space supports for raceway in accordance with NEC.
 - 7. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.
 - 8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.
- E. All hangers installed below the slab shall be stainless steel and attached to the building slab.
- F. Vertical Conductor Supports: Install simultaneously with installation of conductors.

- G. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.
- H. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.
- I. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. For sleeves through fire-rated wall or floor construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduits and cables in accordance with requirements of Division 7 Section "Joint Sealants."
- J. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.
- K. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:
 - 1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
 - 2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
 - 3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.
- L. Test pull-out resistance of one of each type, size, and anchorage material for the following fastener types:
 - 1. Expansion anchors.
 - 2. Toggle bolts.
 - 3. Powder-driven threaded studs.
 - 4. E-Z type anchors.
- M. Provide all jacks, jigs, fixtures, and calibrated indicating scales required for reliable testing. Obtain the Architect's approval before transmitting loads to the structure. Test to 90 percent of rated proof load for fastener. If fastening fails test, revise all similar fastener installations and retest until satisfactory results are achieved.

END OF SECTION

SECTION 26 0533
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes raceways and various types of electrical boxes, tubs, and enclosures for electrical wiring.

1.02 SUBMITTALS

- A. Product data for conduit, surface raceways, and floor boxes.
- B. Shop drawing for the installation of conduit in and under the slab.

1.03 QUALITY ASSURANCE

- A. Comply with NEC for components and installation. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
- B. The Terms "Listed" and "Labeled" as defined by the NEC, Article 100.
- C. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined by OSHA Regulation 1910.7.
- D. Comply with NECA "Standard of Installation."
- E. Coordinate layout and installation of raceway with other construction elements to ensure adequate headroom, working clearance, and access.
- F. Comply with UL 50, UL 514, and UL 886. Provide electrical boxes and fittings which are UL listed for that use.

PART 2 - PRODUCTS

2.01 CONDUITS AND TUBING

A. TYPES

1. Rigid Steel Conduit (RSC): Rigid steel conduit shall be heavy wall, hot-dipped galvanized or electro-galvanized. Conduit shall be in standard 10 foot lengths, threaded on both ends. Each length shall bear an UL label showing the manufacturer's name and/or trade mark. The label shall also designate the primary protective coating. The conduit shall have the inside and outside surfaces of each length thoroughly protected against corrosion by an even coating of zinc. Zinc coating of the finished shall have an even, smooth appearance and be of uniform quality for the entire length. The zinc coating shall be protected by a coating of acid and alkali-resisting lacquer on the inside and outside of each length. Rigid steel conduit shall comply with ANSI C80.1 and UL 6. Minimum size of 3/4".
2. Intermediate Metal Conduit (IMC): Except for the wall thickness, the intermediate metal conduit shall comply with the requirements of Rigid Steel Conduit. Intermediate metal conduit shall comply with ANSI 80.6 and UL 1242. Minimum size of 3/4".
3. Electrical Metallic Tubing (EMT): Electrical metallic tubing shall be zinc coated steel tubing. The inside surface shall be coated with zinc or enamel. The coating on the inside and outside shall have an even and smooth appearance and be of uniform quality for the entire length. The tubing shall be in standard 10 foot lengths. Each length shall bear an UL label showing the manufacturer's name and/or trade mark. The label shall also designate the primary protective coating. Electrical metallic tubing shall comply with ANSI C80.3 and UL 797. Minimum size of 3/4".
4. Rigid Nonmetallic Conduit: Rigid nonmetallic conduit shall be schedule 40 or 80 polyvinyl chloride (PVC) rated for use with 90 degree C conductors and sunlight resistant. The conduit shall be in standard 10 foot lengths. Each length shall bear an UL label showing the manufacturer's name and/or trade mark. Rigid nonmetallic conduit shall comply with UL 651. Minimum size of 3/4".

5. Flexible Steel Conduit: Flexible steel conduit shall be continuous length of spirally wound, interlocked zinc-coated strip steel. Flexible steel conduit shall comply with UL 1. Install separate ground conductor across flexible connections. Minimum size of 1/2".
6. Liquid-tight Flexible Steel Conduit: Liquid-tight flexible steel conduit shall be continuous length of spirally wound, interlocked zinc-coated strip steel coated with flexible polyvinyl chloride. Liquid-tight flexible steel conduit shall comply with UL 360. Install separate ground conductor across flexible connections. Minimum size of 1/2".
7. Aluminum Conduit: Shall be rigid and in standard 10 foot lengths, threaded on both ends. Each shall bear an UL label showing the manufacturer's name and/or trade mark. Aluminum conduit shall comply with UL 6A and ANSI C80.5. Minimum size of 3/4".
8. MC Cable: See Section 26 05 19 for requirements.
9. High-Density Polyethylene (HDPE) Conduit: Schedule 80 only, Meet requirements of NEMA Pub. No. TC 7-2000 for EPEC-80-HDPE and UL 651B and be UL listed for intended use. Minimum size of 3/4".

2.02 BOXES

A. DEVICE BOXES AND ACCESSORIES

1. Provide galvanized coated flat-rolled sheet-steel non-gangable device boxes, (2 1/8" deep minimum) of shapes, cubic inch capacities, and sizes, suitable for installation at respective locations.
2. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices.
3. Provide cable clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding.
4. Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations.
5. Use appropriate box brackets and support to minimize box movement into wall.
6. Use wet location while in use covers for receptacles, where appropriate.

B. FLOOR BOXES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Wiremold
 - b. Hubbell
 - c. Thomas & Betts
2. Standards
 - a. Comply with UL 514A
 - b. Comply with NEC 300.21
3. Construction
 - a. Shall be stamped steel and approved for use on above grade floors.
 - b. Box shall be 13" long by 10" wide by 3 7/16" high.
 - c. Shall be 4 independent wiring compartments that allow capacity for up to four duplex receptacles and/or communication services.
 - d. Shall be fully adjustable, providing a maximum of 2" pre-pour adjustment and a maximum of 1" after-pour adjustment.
 - e. Provide device mounting plates that accept devices shown on plan.

- f. Provide wiring devices and telecommunication outlets as shown on drawings. See Divisions 26 27 26 and 27 00 00 for wiring devices.
 - g. Provide flangeless, die-cast aluminum activation covers with a black powder-coated paint finish.
 - 4. Installation
 - a. The minimum concrete pour depth shall be 3 7/16" plus 1/16" above the top of the box.
 - b. The box shall contain four locations to accommodate leveling for pre-concrete pour adjustment and shall provide four leveling screws for the pre-pour adjustment
- C. RAIN-TIGHT OUTLET BOXES
 - 1. Provide corrosion-resistant cast-metal raintight outlet wiring boxes with threaded conduit holes for fastening electrical conduit, cast-metal face plates with spring-hinged watertight caps suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners.
- D. PANELBOARD TUBS
 - 1. Tubs shall be provided by the panelboard manufacturer.
- E. JUNCTION AND PULL BOXES
 - 1. Provide galvanized code-gage sheet steel junction and pull boxes, with screw-on covers, welded seams and equipped with plated steel nuts, screws, and washers.
 - 2. Provide junction and pull boxes where required to facilitate pulling of wire whether specified or not on drawings.
 - 3. Maximum of 359 degrees of total turning radius shall be allowed between two pull points.
- F. BUSHINGS, KNOCKOUT CLOSURES AND LOCKOUTS
 - 1. Provide corrosion-resistant box knockout closures, conduit locknuts, and malleable iron conduit bushings, offset connectors, to suit respective installation requirements and applications.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 RACEWAY APPLICATION

- A. Rigid Steel or Intermediate Metal Conduit:
 - 1. Install rigid steel conduit or intermediate metal conduit for the following conditions:
 - a. Outdoor installations exposed or on rooftop
 - b. Indoor conduit over 4" diameter
 - c. Conduit subject to water or physical damage, unless otherwise specified
 - d. Installations in hazardous-classified areas
 - e. RGS elbows shall be used where conduit below the slab turns up to go above the slab and shall be extended to a minimum of 3" above the slab.
- B. Electrical Metallic Tubing (EMT):
 - 1. Install electrical metallic tubing for wiring less than 600 volts and in dry locations for the following conditions:
 - a. Indoor branch circuits

- b. EMT may be installed exposed above suspended ceilings in office areas or in partitions in office areas
 - c. EMT shall not be used in concrete, direct burial, or in water softener areas or similar corrosive locations.
 - d. Panelboard and mechanical equipment feeders
- C. Rigid Nonmetallic Conduit:
 - 1. Install rigid nonmetallic conduit (PVC) for the following conditions:
 - a. Underground branch circuits and feeders and shall be supported from the slab when routed under the slab.
 - b. Underground signal, control, and communication circuits and shall be supported from the slab when routed under the slab.
 - c. Conduit installed in slab or other flat concrete.
 - 2. When PVC is used at turn up above grade or above finished slab, only schedule 80 shall be used at the turn up location.
- D. Liquid-Tight Flexible Steel Conduit:
 - 1. Install liquid-tight flexible steel conduit for the following conditions:
 - a. Connections to equipment subject to vibration, movement, or noise transmission such as motors, transformers, generators, dimmer banks.
 - b. Exterior equipment connections
 - 2. Maximum length is 6 feet.
- E. Aluminum Conduit
 - 1. Conduit subject to chemical reactions causing corrosion.
 - 2. Conduit routed exterior to the building and within 50' of a cooling tower
- F. MC Cable: See Section 26 0519 for uses.
- G. High-Density Polyethylene (HDPE) Conduit
 - 1. Install HDPE conduit for the following conditions
 - a. All conduit requiring boring for installation
 - b. Conduits between telecommunication hand holes and telecommunication man holes

3.03 INSTALLATION

- A. Raceway below slab and below grade:
 - 1. All raceway routed under the slab shall be supported by the slab using the same hanger spacing as supported from structure above. The soil cannot be used as support when routed under the slab.
 - 2. Raceway installed outside of the building footprint shall be buried a minimum of 12" below finished grade.
- B. All conduits installed in exposed structure areas with no ceilings and above ceilings that are partially see through shall be installed as follows:
 - 1. In groups and in tight rows, perpendicular and parallel to the building structure, in a clean and workmanlike manner through the space.
 - 2. Conduits serving devices located in these spaces shall remain with the conduit grouping until perpendicular to the device it serves and then turn 90 degrees to the device.
 - 3. Conduits passing through these spaces shall remain grouped and in tight rows for the entire length that it passes through these spaces.
 - 4. All conduit routing in these areas shall be reviewed by the Architect.
- C. Installation of electrical boxes, tubs and enclosures shall be coordinated with other trades.

- D. All branch circuits shall be routed in conduit, at a minimum, to within 15' of the first device the circuit serves before transitioning to multi-conductor cable.
- E. Conceal all conduit within finished walls, ceilings, and floors unless otherwise noted.
- F. Conduits shall not be encapsulated by fire proofing or any other material.
- G. Provide labels and identification per NEC requirements and 26 05 53.
- H. Additional expense incurred by the Contractor as a result of ill timed work will be born by the Contractor, at no additional charge to the Owner.
- I. Install all electrical raceways and factory assemblies in accordance with manufacturer's written installation instructions, applicable requirements of NEC.
- J. Complete installation of electrical raceways before starting installation of conductors within raceways.
- K. Use approved conduit hangers and support conduit in a neat and orderly manner regardless of location.
- L. Die cast conduit couplings and connectors are prohibited.
- M. Keep raceways at least 6 inches away from parallel runs of flues or hot water pipes.
- N. Install raceways level and square and at proper elevations.
- O. Where possible, install horizontal raceway runs above water piping.
- P. Prevent foreign matter from entering raceways by using temporary closure protection.
- Q. Make bends and offsets so the inside diameter is not effectively reduced. Keep the legs of a bend in the same plane and the straight legs of offsets parallel.
- R. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions.
- S. When conduit extends below the bottom of a slab on the ground, the slab shall be thickened in the area of the conduit so as to encase the conduit in concrete by at least 2 inches on all sides.
- T. Where high voltage conduit or fiber duct is laid beneath the floor slab of a building, there shall be a minimum of 6 inches of sand fill between the outside of the concrete envelope around the conduit and the underside of the floor slab.
- U. RGS elbows shall be used where conduit below the slab turns up to go above the slab and shall be extended to a minimum of 3" above the slab.
- V. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- W. Raceways embedded in slabs: Install in middle third of the slab thickness where practical and leave at least 1 inch concrete cover. Tie raceways to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Place raceways laterally to prevent voids in concrete. Run conduit larger than one inch parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.
- X. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor where equipment connections are not to be made under this contract, install screwdriver-operated threaded flush plugs flush with floor.
- Y. Exposed raceways: Install parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical.
- Z. Run exposed, parallel, or banked runs from the same centerline so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel. This requires that there be a change in the plane of the run such as from wall to ceiling and that the raceways be of the same size. In other cases provide field bends for parallel raceways.

- AA. Join raceways with fittings designed and approved for the purpose and make joints wrench tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.
- BB. Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box. Bushings on all conduit 1 inch and larger shall be insulating type.
- CC. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
- DD. Expansion fittings shall be used in all conduit runs crossing expansion joints, where required by NEC, or manufacturers recommendations.
- EE. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL listed sealing compound. For concealed raceways, 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 locations:
 - 1. Where conduits enter or leave hazardous locations.
 - 2. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air conditioned spaces.
 - 3. Where required by NEC.
- FF. Install pull wires in all empty raceways. Use monofilament plastic line having not less than 100 lb tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.
- GG. Seal spare and empty conduits with a conduit cap or plug to which the pull wire is attached.
- HH. Conduit fill: Do not exceed 30 percent conductor fill in conduits, containing branch circuit conductors. Do not exceed NEC requirements for all other conduits.
- II. Conductor derating: Derate conductor ampacity in accordance with NEC raceway fill requirements. Do not fill raceways so that conductor derating will exceed 50 percent.
- JJ. Provide boxes flush mounted in walls for switches, receptacles, telecommunications outlets, and manual motor starters.
- KK. Provide rain-tight outlet boxes for interior and exterior locations exposed to weather or moisture.
- LL. Install all boxes level and square.
- MM. Install switch boxes six inches from latch side of door openings.
- NN. Do not install aluminum products in concrete.
- OO. Do not install boxes back-to-back or use through-the-wall boxes.
- PP. Set floor boxes level and flush with finished flooring material.
- QQ. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed boxes in concrete or masonry. Support boxes independently of conduit system.
- RR. Install cover plates and plug unused openings in boxes, raceways, cabinets, and equipment cases to afford protection equivalent to the wall of the equipment.

END OF SECTION

SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. The work of this section consists of providing labor, materials, tools, appliances and miscellaneous accessories associated with electrical identification as indicated herein and on the Drawings.
- B. Types of electrical identification specified in this section include the following:
 - 1. Cable/Conductor identification
 - 2. Operational instructions and warnings
 - 3. Danger signs
 - 4. Equipment/system identification signs
 - 5. Code required identification

1.02 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NEC.

PART 2 - PRODUCTS

2.01 ELECTRICAL IDENTIFICATION MATERIALS

- A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than one type is specified for an application, selection is Installer's option, but provide single selection for each application.
- B. Provide identification and signage for all emergency systems, services, and other systems as required per NEC.
- C. Cable/Conductor Identification Bands: General: Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor wire markers or wrap-around type, either pre-numbered plastic coated type, or write on type with clear plastic self-adhesive cover flap, numbered to show circuit identification.
- D. Self-adhesive Plastic Signs: Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings, of sizes suitable for application areas and adequate for visibility, with proper wording for each application (as examples: "208V", "EXHAUST FAN", "RECTIFIER"). Unless otherwise indicated or required by governing regulations, provide orange signs with black lettering.
- E. Danger Signs: Provide Manufacturer's standard "DANGER" signs of baked enamel finish on 20-gage steel, of standard red, black and white graphics, 14" x 10" size except where 10" x 7" is the largest size which can be applied where needed and except where larger size is needed for adequate vision, and with recognized standard explanation wording (as examples: "HIGH VOLTAGE", "KEEP AWAY", "BURIED CABLE", "DO NOT TOUCH SWITCH").
- F. Engraved Plastic-Laminate Signs: Provide engraved stock melamine plastic-laminate, complying with FS L-P-387, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, black and 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", for units up to 20 sq. in. or 8" length, 1/8" for larger units.
 - 2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.02 LETTERING AND GRAPHICS

- A. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified for scheduled. 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 electrical system and equipment.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

- A. General Installation Requirements:
 - 1. Coordination: Where identification to be applied to surfaces which require finish, install identification after completion of painting.
 - 2. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.
- B. Cable Tray Identification: Label tray as required by NEC 392.18.
- C. Cable/Conductor Identification:
 - 1. Apply cable/conductor identification on each box/enclosure/cabinet where wires are present. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project electrical work.
 - 2. Conductors shall be clearly and permanently identified.
 - 3. All control circuit and instrument circuit terminations shall be identified. For conductors #6 and smaller, conductor color coding shall be color insulation. For conductor color coding of wire larger than #6, use self-adhesive wrap around tape markers. Use markers at all panelboards, boxes, outlets, switches, circuit breakers and control centers.
- D. Operational Instructions and Warnings: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.
- E. Equipment/System Identification:
 - 1. Install engraved plastic-laminate sign on each major unit of electrical equipment in building unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1-1/2" high sign (2" high where 2 lines are required), white lettering in black field.
 - 2. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for the following categories of electrical work:
 - a. Panelboards, electrical cabinets and enclosures
 - b. Access panel/doors to electrical facilities
 - c. Disconnect Switches
 - d. Transformers
 - e. Fire alarm master station
 - 3. For all service equipment, provide nameplate stating available fault current at equipment. Verify available fault current with Architect.
 - 4. Provide identification for all emergency system equipment, service equipment, and other systems per NEC requirements.
 - 5. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate the substrate.

END OF SECTION

SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. Extent of lighting control equipment work is indicated by drawings and schedules, and is hereby defined to include, but not by way of limitation, photocells, lighting contactors, and time switches.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Maintenance Manuals: Furnish maintenance manuals which contain equipment cuts, operating instructions, troubleshooting procedures and spare parts list for equipment. Ensure manual includes operating instructions.
- C. Sensor Layout Shop Drawing: Provide a shop drawing showing proposed sensor layout. Drawing shall show complete reflective ceiling plan with light fixtures, diffusers, fire alarm devices, and sensors. The coverage patterns of the sensors shall be shown. The drawing shall be produced by the sensor manufacturer.
- D. Dimming System Wiring Diagram: Provide a one-line wiring diagram showing all required wiring between devices. The drawing shall be produced by the dimming system manufacturer.

1.03 QUALITY ASSURANCE

- A. Installer's Qualifications: Firm with at least 5 years of successful installation experience on projects with lighting control equipment work similar to that required for this project.
- B. Codes and Standards:
 - 1. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors
 - 2. UL 924 - Safety and Emergency Lighting and Power Equipment
 - 3. NEMA 250 - Enclosures for Electrical Equipment (1000-Volts Maximum)

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver lighting control equipment and components in factory-fabricated type containers or wrappings, which properly protect equipment from damage.
- B. Store lighting control equipment in original packaging and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.
- C. Handle lighting control equipment carefully to prevent physical damage to equipment and components. Do not install damaged equipment; remove from site and replace damaged equipment with new.

1.05 WARRANTY

- A. Special Warranty for sensors, digital time switches, and power packs: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Sensors, Digital Time Switches, and Power Packs: 3 years from date of Substantial Completion.

1.06 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sensors: 2 per floor of each type installed
 - 2. Power Packs: 2 per floor of each type installed

PART 2 - PRODUCTS

2.01 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. Exterior Photocells:
 - a. Tork
 - b. Intermatic
 - c. Paragon
 - d. Leviton
 - e. Acuity
 - f. Douglas
 - 2. Lighting Control Panel
 - a. Watt-Stopper
 - b. Lutron
 - c. Leviton
 - d. Acuity
 - 3. Dimming Control, Occupancy Sensors, Digital Time Switches, & Interior Photosensors
 - a. Watt-Stopper
 - b. Lutron
 - c. Leviton
 - d. Sensor Switch

2.02 EXTERIOR PHOTOCELLS

- A. Photocells shall be conduit mounted, 120 volt or 277 volt depending on the application, rated 2000 watts with single pole, single throw contacts.
- B. Adjustment range 2 fc to 50 fc.
- C. Photocell shall not be effected by moisture and operate from -40 deg C to +60 deg. C.

2.03 INTERIOR PHOTOCELLS

- A. Adjustment range 0 fc to 500 fc
- B. Automatically dims/brightens 0-10 VDC ballasts as daylight changes via Bus Supply
- C. See schedule for more information

2.04 LIGHTING CONTROL PANEL

- A. Description
 - 1. Lighting Control Panels shall be UL listed and consist of the following:
 - a. Enclosure/Tub: NEMA 1
 - b. Cover: Surface or Flush as required, hinged, lockable and shall restrict access to line voltage section.
 - c. Interior: Barrier for separation of high voltage (class 1) and low voltage (class 2) wiring. It shall include intelligence boards, power supply and control relays. Clock display and keypad shall be mounted on interior cabinet door for easy user access and programming.
- B. Features
 - 1. Panel shall accept up to 12 single pole relays. Relays shall be individual latching relays with 20 Amp load contacts for ballast (including HID, magnetic or electronic type ballasts), tungsten and general purpose loads. Provide isolated auxiliary contacts for pilot

light switching. Relays shall use quick connectors and be individually replaceable to facilitate ease of use.

2. Where indicated, panels shall provide space within the high voltage section of the enclosure to accommodate up to 6 multi-pole contactors. Two sections of DIN rail mounting shall be provided as standard. No field drilling or fabrication shall be required for mounting contactors or other accessories within the enclosure.
3. The lighting control panel shall provide a stagger up delay, override push buttons, pilot light outputs, and LED status light indicators for each relay or contactor control channel.
4. The clock shall have a backlight display, user keypad and shall provide 8 channels of time or astronomical control. Preprogrammed lighting control scenarios shall include: scheduled on/off, manual on/scheduled off, manual on/automatic switch sweep off, astronomic or photocell on/off and astronomic or photocell control with scheduled on/off. Time clock shall provide holidays, automatic daylight savings adjustment, astronomic coordinates by major cities, and help screens. Program memory shall be non-volatile and clock shall retain time keeping during power outages for at least 48 hours.
5. The panel shall have 4 universal switch inputs that are low voltage, self-configuring and shall not require programming to accept momentary on/ momentary off switch, push button switch (cycling), maintained switch or 24VDC signals from occupancy sensors, photocells or other interfacing devices.
6. Occupancy sensor and time control shall be integrated to allow occupancy sensor control after hours with hold on of lighting during occupancy scheduled time. During occupied time, control scenarios shall be selectable for time schedule of lighting on or occupancy sensor detection of lighting on initially and then hold on of lighting during occupied hours. Control shall provide selectable occupancy sensor blink warning prior to shut off and adjustable occupancy sensor time delay from the time clock keypad.
7. After-hour interior lighting shut off control shall provide a full duration override time of 1 to 240 minutes with a warning blink five minutes prior to shutting the lighting off. An impending shut off will be cancelled and the override period re-initialized through the operation of any assigned switch input.
8. After-hour interior lighting shut off control may be by line voltage power interrupt control to automatic control switches. The lighting control relay panel shall provide a warning blink signal to automatic control switches, thus allowing a five-minute delay prior to shutting off lighting. The lighting shut off event may be cancelled by pressing the automatic control switch push button. The lighting control panel time clock shall provide periodic lighting sweep signals to shut off automatic control switches.
9. Wiring between control panel and low voltage devices shall use Cat. 5 patch cables with RJ45 connectors.

2.05 OCCUPANCY SENSORS

A. Wall Mounted

1. The unit shall fit in or on a standard single gang switch box and require only two wires and a grounded box for operation.
2. Sensitivity shall be adjustable.
3. The delay timer shall be adjustable with a range of 5 to 30 minutes minimum.
4. The off switch shall have manual override for positive off and positive on.
5. The test LED shall indicate motion.
6. The unit shall be UL listed for intended use.
7. See schedule for more information.

B. Ceiling Mounted

1. The unit shall fit in or on a standard octagon box.

2. The sensitivity shall be adjustable
3. The delay timer shall be adjustable 5 to 30 minutes minimum range.
4. The sensor shall have provisions, such as masking, to block out problem areas.
5. Test LED to indicate motion.
6. The unit shall be UL listed for intended use.
7. See schedule for more information.

2.06 DIMMING CONTROL SYSTEM

- A. System shall be wired.
- B. The system shall perform all of the following functions:
 1. Switch emergency light fixture to full brightness upon loss of normal power.
 2. Occupancy sensors shall allow lights to be on/off
 3. Daylight sensors shall impose a high-end limit for light output in a particular lighting zone.
 4. Wall stations shall dim the light levels up to the daylight sensor limit.
 5. Wall stations shall be able to dim the light levels of all fixtures in a particular lighting zone.
 6. After a power failure, all devices shall return to their previous light levels prior to the power failure.
- C. Bus Supply
 1. Provide bus supplies from the dimming control manufacturer as required to operate the lighting control zones as described.
 2. The Contractor shall connect power to the bus supply via the lighting circuit serving the lighting zone. If connecting the buss supply to a normal lighting circuit is required to switch emergency light fixtures to full brightness upon loss of normal power, then connect to the nearest normal lighting circuit serving the space.
- D. Low Voltage Wall Stations
 1. Provide from the dimming control manufacturer.
 2. Class 2 (low voltage)

2.07 ROOM CONTORLLERS/ DIGITAL POWER PACKS

- A. Provide as required per the sensor manufacturer's recommendations to operate the lighting control zones as described.
- B. Universal input voltage
- C. Self-contained power supply and relay module
- D. Dry contacts capable of switching 20-amp ballast and incandescent loads and circuited voltage.
- E. LED indicator status of relay
- F. Over-current protection for low voltage output.
- G. UL 2043 plenum rated
- H. UL 924 for emergency lighting control units.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which lighting control equipment is to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION

- A. Install lighting control system components and ancillary equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements. Comply with requirements of NEC, and applicable portions of NECA's Standard of Installation" pertaining to general electrical installation practices.
- B. Furnish and install all required low voltage cabling to interconnect lighting control devices and control panels.
- C. Program all sensors, wall stations, and dimming control systems.
- D. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work.
- E. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B.
- F. Time Delay Test: Set the time delay. Walk into the room to activate the sensor then leave room. Sensor must turn lights off after time delay.
- G. Contractor shall provide sensor adjustment and relocation and system reprogramming per Owner's request after 6 months of substantial completion being awarded.

3.03 SENSOR SETTINGS

SPACE TYPE	TURN ON	TME DELAY	UNOCCUPIED MODE
OFFICE	MANUAL	20 MINUTES	LIGHTS OFF
MEETING ROOM	MANUAL	20 MINUTES	LIGHTS OFF
CLASSROOMS	MANUAL	20 MINUTES	LIGHTS OFF
BREAK ROOM	AUTO	20 MINUTES	LIGHTS OFF
COPY/PRINT	AUTO	20 MINUTES	LIGHTS OFF
CORRIDORS	AUTO	20 MINUTES	DIM TO 30%
CORRIDORS	AUTO	60 MINUTES	LIGHT OFF
LOBBIES	AUTO	20 MINUTES	DIM TO 30%
LOBBIES	AUTO	60 MINUTES	LIGHTS OFF
RESTROOMS	AUTO	20 MINUTES	LIGHTS OFF

3.04 FIELD QUALITY CONTROL

- A. Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting. Testing and retesting at no cost to Owner.

3.05 DEMONSTRATION

- A. Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and operating lighting control system equipment. Provide at least 3 hours of training.

END OF SECTION

SECTION 26 2213 TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

- A. The work of this section consists of providing labor, materials, tools, appliances and miscellaneous accessories associated with the transformer work indicated herein and on the Drawings.

1.02 SUBMITTALS

- A. Product Data: For each type of transformer, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each transformer and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of transformers.
 - d. Descriptive documentation of optional barriers specified for electrical insulation and isolation.
 - e. Features, characteristics, ratings, and factory settings

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products of one of the following (for each type of transformer):
 - 1. Square D
 - 2. Eaton
 - 3. ABB

2.02 TRANSFORMERS, GENERAL

- A. Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.

2.03 GENERAL PURPOSE DRY TYPE TRANSFORMERS

- A. Comply with Department of Energy 2016
- B. Comply with NEMA Standard ST 20 "Dry-Type Transformers for General Applications".
- C. Windings: 2-winding type. Three phase transformers shall use one coil per phase in primary and secondary.
- D. Provide all aluminum or copper windings.

2.04 FEATURES & RATINGS

- A. Enclosures:
 - 1. Indoor: ventilated, drip-proof
 - 2. Outdoor: ventilated, with drip shield, suitable for outdoor use
- B. Insulation Class:
 - 1. < 15 KVA: 185 degree C class
 - 2. > 15 KVA: 220 degree C class

- C. Insulation Temperature Rise: 150 degree C maximum rise above 40 degree C unless otherwise noted
- D. Taps: For transformers 3 KVA and larger, full capacity taps in high-voltage winding as follows:
 - 1. 3 - 10 KVA: (2) 5% taps below rated high-voltage
 - 2. 15 - 300 KVA: (6) 2.5% taps, 2 above and 4 below rated high-voltage
 - 3. 500 - 1000 KVA: (4) 2.5% taps, 2 above and 2 below rated high-voltage
- E. Efficiency: > 97% from 35% load to 100% full load.
- F. Impedence: < 5.8%
- G. Isolate core and coil from enclosure using vibration absorbing mounts.

2.05 ACCESSORIES

- A. Wall mounting brackets: Manufacturers standard brackets for transformers sized up to 75 KVA where wall mounting is indicated.

2.06 SOUND LEVELS

- A. Sound levels shall be warranted by the manufacturer not to exceed the following:
 - 1. 15 to 50 KVA – 50dB
 - 2. 51 to 150 KVA - 55dB

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install transformers as indicated, complying with manufacturer's written instructions, applicable requirement of NEC, NEMA, ANSI and IEEE standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.
- B. Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.
- C. Install units on vibration mounts; comply with manufacturer's indicated installation method if any.
- D. Connect transformer units to electrical wiring system; comply with requirements of other Division 26 sections.
- E. Install label nameplate as required.
- F. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A and B.
- G. Floor mounted transformer to be mounted on housekeeping pad.

3.02 GROUNDING

- A. Provide equipment grounding connections for power/distribution transformers as required and/or indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounding.
- B. Provide service grounding electrodes and connections as required by the NEC for a separately derived electrical system.

3.03 TESTING

- A. Prior to energization of transformers, check all accessible connections for compliance with manufacturer's torque tightening specifications.
- B. Prior to energization, check circuitry for electrical continuity, and for short-circuits.
- C. Upon completion of installation of transformers, energize primary circuitry at rated voltage and frequency from normal power source, and test transformers, including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements, where possible,

correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units or components, and proceed with testing.

END OF SECTION

SECTION 26 2416 PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

- A. The work of this section consists of providing labor, materials, tools, appliances and miscellaneous accessories associated with panelboard work indicated herein and on the Drawings and schedules.

1.02 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, SPD device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. Mimic-bus diagram.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- C. Wiring Diagrams: power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- D. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Closeout Procedures," include the following:
 - 1. Routine maintenance requirements for panelboards and all installed components.
 - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 3. Time-current curves, including selectable ranges for each type of overcurrent protective device.
- E. Panelboard submittals requiring a resubmittal shall only have the panelboards that were marked with comments be resubmitted. Panelboards in previous submissions that were not marked with comments will not be rereviewed unless the Contractor states in writing why that panelboard was resubmitted (circuit breaker has changed, rating has changed, etc).

1.03 COORDINATION STUDY

- A. Provide an overcurrent protection device coordination study to be submitted to the Architect for approval. Contractor shall hire a third party consultant or hire the overcurrent protection device manufacturer to do the study. The study shall include all time and materials for initial submissions and all resubmissions until study is approved by Architect.
- B. The study shall use inverse time graphs to show coordination for instantaneous trip and over load trip settings of the devices to be coordinated and clearly show the actual setting for the device to be set at.
- C. The following devices, at a minimum, shall be coordinated in the study:
 - 1. Overcurrent protection devices and ground fault current interrupters in the main switchboard
 - 2. Overcurrent protection devices in emergency switchboard
 - 3. Overcurrent protection device serving as the main for the mechanical switchboard

4. Overcurrent protection devices in generator and automatic transfer switches
 5. Overcurrent protection devices serving as mains for panelboards
 6. Feeder cables being served by the overcurrent protection devices being coordinated
 7. Transformers being served by the overcurrent protection devices being coordinated
- D. The study shall include final arc flash ratings of all switchboards, panelboards, and disconnects in the contract. The arc flash rating shall be labeled on all equipment using the UL listed label for that equipment.
- E. Final approved settings shall be set in the field for all devices being coordinated

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products of one of the following for each type of panelboard and enclosure:
1. Square D
 2. Eaton
 3. ABB

2.02 CONSTRUCTION

- A. Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information; equip with number of unit panelboard devices required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL and established industry standards for applications indicated.
- B. Lighting and appliance panelboards shall be dead front safety-type equipped with molded case circuit breakers as shown and scheduled.
- C. Main lugs or main overcurrent units shall be furnished for panelboards as indicated on the Drawings. The number of branches in each panel shall be as indicated on the Drawings.
- D. Panelboards shall be mounted in code gauge galvanized sheet steel cabinets with corners lapped and riveted or fastened by other approved methods. Cabinets shall be of such size as to allow a wiring gutter space of at least 6" all around for power panels, and 4" all around for lighting panels. Extra large gutter spaces shall be provided if specifically called for.
- E. Panelboards shall be flush or surface mounted as indicated on the Drawings. Trim for each panel shall be suitable for the type of mounting. Each trim shall be complete with suitable hinged door having chrome plated flush type combination lock and catch, except that for doors over 48" in height a chrome plated vault handle and 3 point catch shall be provided with built-in lock arranged to fasten door at top, bottom and center. Two keys shall be provided for each lock and each key shall open all panelboards furnished. All trims shall be of a type that is self-supporting on the box after the trim holding screws have been removed. All free-standing cabinets shall be secured to floors, walls, and columns with approved angle iron or unistrut framework. Framework shall be painted as cabinets.
- F. Each panelboard shall be complete with main copper or aluminum bus run up the center and neutral bars where required and all proper sequence phase connections. Polarized panelboards will not be accepted. Spacing of busses shall not be less than code requirements. Busses shall be arranged for single or 3-phase, 3- or 4-wire supply as indicated on the Drawings. Busses shall be provided with suitable phase identification.
- G. Directory holder with metal frame shall be furnished and installed upon of door of each cabinet, with complete typewritten circuit schedule inserted.
- H. The inside and outside of panelboard boxes, doors and trims shall be furnished with at least two coats of manufacturer's standard finish paint over a baked-on prime cost.
- I. Provide ground bus. Provide additional isolated ground bus where specified.

- J. Branch mounted main circuit breakers may only be used for panels rated 100 amps or less.
- K. Series rated panelboards shall not be used.

2.03 LIGHTING AND BRANCH CIRCUIT PANELBOARDS

- A. Panels shall be for use on 4-wire, 60 cycle, solid neutral service, with number and size of bolt-on type circuit breaker branches as shown on the Drawings. Circuit breaker's interrupting capacity shall match the panels rating. Refer to plans for panel rating.
- B. For multiple section panelboards, route the grounding conductor full size from ground buss to ground buss. Metal to metal cabinet grounding is not solely sufficient. The buss rating shall be continuous through each section, not tapered or diminished in size or rating. Cable from one section to another shall be full capacity and not reduced.
- C. Provide feed-thru lugs for all 208Y/120V panelboards, where specified on plans or not.

2.04 POWER AND DISTRIBUTION PANELBOARDS

- A. Distribution, Lighting and Appliance Panelboards: Provide dead-front safety constructed factory assembled circuit breaker type panelboards in sizes and ratings as indicated. Construct with plated rectangular shaped aluminum or copper bus bars, which are securely mounted and braced, and with lugs bolted to main bus bars. Provide anti-turn solderless pressure type lug connectors approved for copper conductors, for connecting feeders. Provide full-sized neutral bus bar with suitable lugs for circuits requiring neutral connection. Provide main and branch circuit breakers. Breakers should be molded case bolt-in type, heavy-duty, quick-make, quick-break, with toggle handles that indicate when tripped. Where multiple breakers are indicated, provide with common trip so that overload on one pole will trip all poles simultaneously. Provide suitable lugs on neutral bus for each outgoing feeder required; provide bare un-insulated grounding bars suitable for bolting to enclosures with suitable lugs for incoming and outgoing equipment grounding conductors. Load center type panelboards are not acceptable.
- B. For multiple section panelboards, route the grounding conductor full size from ground buss to ground buss. Metal to metal cabinet grounding is not solely sufficient. The buss rating shall be continuous through each section, not tapered or diminished in size or rating. Cable from one section to another shall be full capacity and not reduced.
- C. Panelboards larger or equal to 400 amps shall have piano-hinge trim.

2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents
 1. 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.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
 - a. Instantaneous trip
 - b. Long- and short-time pickup levels
 - c. Long- and short-time time adjustments
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles
 1. Pad Lock: Provide pad lock feature for lock out/tag out on all circuit breakers in panelboards serving HVAC equipment (ACCU, AHU, RTU, VAV).

2. For circuit breakers adjustable to 1200A or higher: Provide an arc flash reduction switch/mode with blue indication light to comply with NEC Article 240.
3. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
4. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
5. Handle ties: Provide as required to simultaneously disconnect all ungrounded conductors that are part of a multiwire branch circuit.
6. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated with field-adjustable 0.1- to 0.6-second time delay.
8. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

2.06 SPD DEVICES

- A. Provide integral SPDs only in panelboards shown on the Contract Documents.
- B. IEEE C62.41, integrally mounted, plug-in style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules where specified on drawings.
- C. Minimum single-impulse current rating shall be as follows:
 1. Line to Neutral: 120,000 A.
 2. Line to Ground: 120,000 A.
 3. Neutral to Ground: 60,000 A.
- D. Protection modes shall be as follows:
 1. Line to neutral.
 2. Line to ground.
 3. Neutral to ground.
- E. Shall be a Type 1 SPD with a minimum nominal surge current rating of 20,000 amps when integral to service entrance equipment. Shall be a Type 1 or Type 2 SPD with a minimum nominal surge current rating of 10,000 amps in all other cases.
- F. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
- G. Category C combination wave clamping voltage shall not exceed 600 V, line to neutral and line to ground on 120/208 V systems.
- H. UL 1449 clamping levels shall not exceed 400 V, line to neutral and line to ground on 120/208 V systems.
- I. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
- J. Accessories shall include the following:
 1. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
 2. Audible alarm activated on failure of any surge diversion module.
 3. Six-digit transient-counter set to totalize transient surges that deviate from the sine-wave envelope by more than 125 V.

2.07 METER

- A. Provide meters only in panelboards shown on the Contract Documents.
- B. General Provisions

1. All setup parameters required by the Power Meter shall be stored in nonvolatile memory and retained in the event of a control power interruption.
2. The Power Meter may be applied in three-phase, three- or four-wire systems as well as single phase
3. The Power Meter shall be capable of being applied without modification at nominal frequencies of 45 to 65 Hz.

C. Measured values

1. The Power Meter shall provide the following, true RMS metered quantities:
 - a. Real-Time Readings
 - b. Current (Per-Phase, N (calculated), 3-Phase Avg)
 - c. Voltage (L-L Per-Phase, L-L 3-Phase Avg, L-N Per-Phase, L-N 3-Phase Avg)
 - d. Real Power (Per-Phase, 3-Phase Total)
 - e. Reactive Power (Per-Phase, 3-Phase Total)
 - f. Apparent Power (Per-Phase, 3-Phase Total)
 - g. Power Factor (3-Phase Total)
 - h. Frequency
 - i. THD (Current and Voltage)
2. Energy Readings: Accumulated Energy (Real kWh, Reactive kVARh, Apparent kVAh) (Absolute)
3. Demand Readings
 - a. Demand Current Calculations(Per-Phase):
 - 1) Present
 - 2) Peak
 - b. Demand Real Power Calculations(3-Phase Total):
 - 1) Present
 - 2) Peak
 - c. Demand Reactive Power Calculations(3-Phase Total):
 - 1) Present
 - 2) Peak
 - d. Demand Apparent Power Calculations(3-Phase Total):
 - 1) Present
 - 2) Peak
4. Power Analysis Values
 - a. THD - Voltage (Line to Line, Line to Neutral)
 - b. THD - Current (Per-Phase, Neutral)
 - c. Power Factor (3-Phase)

D. Demand

1. All power demand calculations shall use any one of the following calculation methods, selectable by the user using block interval, with optional sub-intervals. The window length shall be set by the user from 1-60 minutes in 1 minute intervals. The user shall be able to set the sub-interval length from 1-60 minutes in 1-minute intervals. The following Block methods are available:
 - a. Sliding Block that calculates demand every 15 seconds with intervals less than 15 minutes and every 60 seconds with an interval between 15 and 60 minutes.

- b. Fixed Block that calculates demand at the end of the interval.
- E. Sampling
 - 1. The current and voltage signals shall be digitally sampled at a rate high enough to provide true rms accuracy to the 15th harmonic.
 - 2. The Power Meter shall provide continuous sampling at a minimum of up to 32 samples/cycle, simultaneously on all voltage and current channels in the meter.
- F. Minimum and Maximum Values
 - 1. The Power Meter shall provide minimum and maximum values for the following parameters:
 - a. Voltage L-L
 - b. Voltage L-N
 - c. Current
 - d. Power Factor
 - e. Real Power Total
 - f. Reactive Power Total
 - g. Apparent Power Total
 - h. THD Voltage L-L
 - i. THD Voltage L-N
 - j. THD Current
 - k. Frequency
 - 2. For each min/max value listed above, the Power Meter shall record the following attributes:
 - a. Min/Max. Value
 - b. Phase of recorded Min/Max (for multi-phase quantities)
 - 3. Minimum and maximum values shall be available via communications and display.
- G. Current Inputs
 - 1. The Power Meter shall accept current inputs from standard instrument current transformers with 5 amp secondary output and shall have a metering range of 0-6 amps with the following withstand currents: 15 amp continuous, 50 amp 10 sec per hour, 120 amp 1 sec per hour.
 - 2. Current transformer primaries through 327 kA shall be supported.
- H. Voltage Inputs
 - 1. The circuit monitor shall allow connection to circuits up to 480 volts AC without the use of potential transformers. The Power Meter shall also accept voltage inputs from standard instrument potential transformers. The Power Meter shall support PT primaries through 1.6 MV.
 - 2. The nominal full scale input of the Power Meter shall be 277 Volts AC L-N, 480 Volts AC L-L. The meter shall accept a metering over-range of 20%. The input impedance shall be greater than 2 mega ohms (L-L) or 1 mega ohms(L-N).
- I. Accuracy
 - 1. The Power Meter shall comply with IEC62053-21 Class 1 and ANSI C12.16 Class.
 - 2. The Power Meter shall be accurate to 1% of reading for power and energy. Voltage and current shall be accurate to 0.5% of reading. Frequency metering shall be accurate .01 Hz at 45-65 Hz.
 - 3. These accuracy's shall be maintained for both light and full loads.

4. No annual calibration shall be required to maintain this accuracy.
- J. Input/Output
1. The Power Meter shall provide 2 digital inputs for status monitoring or pulse counting
 2. The Power Meter shall provide 1 KY solid state output
- K. Feature Addition: It shall be possible to field upgrade the firmware in the Power Meter to enhance functionality. These firmware upgrades shall be done through the communication connection and shall allow upgrades of individual meters or groups. No disassembly or changing of integrated circuit chips shall be required and it will not be necessary to de-energize the circuit or the equipment to perform the upgrade.
- L. Control Power: The Power Meter shall operate properly over a wide range of control power including 110-415 VAC, +/-10% or 125-250 VDC, +/-20%.
- M. Communications: The Power Meter shall communicate via RS-485 Modbus or Jbus protocol with a 2-wire connection at speeds up to 19.2 kBaud.
- N. Display
1. The Power Meter display shall be back lit LCD for easy viewing, display shall also be anti-glare and scratch resistant
 2. The Display shall be capable of allowing the user to view four values on one screen at the same time. A summary screen shall also be available to allow the user to view a snapshot of the system.
 3. The Power Meter display shall provide local access to the following metered quantities:
 - a. Current, per phase rms and neutral (if applicable)
 - b. Voltage, phase-to-phase, phase-to-neutral
 - c. Real power, 3-phase total
 - d. Reactive power, 3-phase total
 - e. Apparent power, 3-phase total
 - f. Power factor, 3-phase total
 - g. Frequency
 - h. Demand current, per phase(if applicable)
 - i. Demand real power, three phase total(if applicable)
 - j. Demand apparent power, three phase total(if applicable)
 - k. Accumulated Energy, (kWh, kVAh, and kVARh)
 - l. THD, current and voltage, per phase(if applicable)
 4. Reset of the following electrical parameters shall also be allowed from the Power Meter display:
 - a. Peak demand current
 - b. Peak demand power (kW) and peak demand apparent power (kVA)
 - c. Energy (MWh) and reactive energy (MVARh)
 5. Setup for system requirements shall be allowed from the Power Meter display. Setup provisions shall include:
 - a. CT rating
 - b. PT rating
 - c. System type
 - d. Communication parameters such as address and baud rate

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install panelboards and enclosures where indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- B. Install approved handle ties on circuit breakers serving multiwire branch circuits as required per NEC.
- C. Coordinate installation of panelboards and enclosures with cable and raceway installation work.
- D. Anchor panelboard assemblies firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure.
- E. Provide properly wired electrical connections for panelboards within enclosures.
- F. Fill out (typewritten) panelboard's circuit directory card upon completion of installation work.
- G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and B.
- H. Provide filler plates for unused spaces in panelboard.

3.02 EQUIPMENT LOCKS

- A. All panelboards, cabinets and other electrical equipment having doors with locks, shall be keyed alike.

3.03 GROUNDING

- A. Provide equipment grounding connections for panelboard enclosures as indicated. Tighten connections to comply with UL tightening torques to assure permanent and effective grounds.

3.04 FIELD QUALITY CONTROL

- A. Prior to energization of panelboards, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.
- B. Prior to energization, check panelboards for electrical continuity of circuits, and for short-circuits.
- C. Prior to energization of circuitry, check all accessible connections to manufacturers tightening torque specifications.

3.05 ADJUSTING AND CLEANING

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred surfaces to match original finishes.

3.06 LABELS

- A. Provide labels and identification per NEC requirements and 26 05 53.
- B. Provide typewritten panelboard schedules with as-built circuitry information.

END OF SECTION

SECTION 26 2726 WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. The work of this section consists of providing labor, materials, tools, appliances and miscellaneous accessories for wiring device work indicated by Drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Maintenance Manuals: Furnish maintenance manuals which contain equipment cuts, operating instructions, troubleshooting procedures and spare parts list for equipment. Ensure manual includes operating instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Subject to compliance with requirements, manufacturers offering devices which may be incorporated in the work include, but are not limited to the following:
 - 1. Bryant Electric Co.
 - 2. Harvey Hubbell, Inc.
 - 3. Pass and Seymour, Inc.
 - 4. Leviton Co.
 - 5. Wiremold Company

2.02 FABRICATED WIRING DEVICES

- A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and complying with NEMA Stds. Pub. No. WD 1. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements, and color devices and wallplates except as otherwise selected.
- B. Receptacles:
 - 1. Duplex: Provide duplex "specification grade" receptacles, 2-pole, 3-wire grounding, with green hexagonal equipment ground screw, ground terminals and poles internally connected to mounting yoke and mounting yoke provided with automatic grounding feature between mounting screws and yoke, 20-amperes, 125-volts, with metal plate ears, back and side wiring, NEMA configuration 5-20R unless otherwise indicated. Pass & Seymour 5362 series (see below for color).
 - 2. Simplex: Provide simplex "specification grade" receptacles, 2-pole, 3-wire grounding, with green hexagonal equipment ground screw, ground terminals and poles internally connected to mounting yoke and mounting yoke provided with automatic grounding feature between mounting screws and yoke, 20-amperes, 125 volts, with metal plate ears, (back and) side wiring, NEMA configuration 5-20R unless otherwise indicated. Pass & Seymour 5361 series (see below for color).
 - 3. Ground-Fault Interrupter: Provide "specification grade" duplex receptacles, ground-fault circuit interrupters (GFCI), feed-thru type, capable of protecting connected downstream receptacles on single-circuit, grounding type UL-rated Class A, 20-amperes rating, 120-volts, 60 Hz, with solid-state ground-fault sensing and signaling, with 5 milliampere ground-fault trip level; equip with 20-ampere plug configuration, NEMA 5-20R with local test/reset buttons and LED signal light to signify power is available. Pass & Seymour 2095 series (see below for color).
- C. Plugs and Connectors: Refer to drawings.

D. Switches

1. Single Pole Toggle
 - a. "Specification grade" flush, quiet, AC-type, single-pole toggle switches
 - b. 20-amperes, 277/125 volts AC, with mounting yoke insulated from mechanism
 - c. Plaster ears, switch handle, side-wired screw terminals (and backwiring with clamp type terminals).
 - d. Pass & Seymour PS20AC1 series (see below for color).
2. Double-Pole Toggle
 - a. "Specification grade" flush, quiet, AC type, double-pole toggle switches
 - b. 20-amperes, 277/125 volts AC, with mounting yoke insulated from mechanism
 - c. Plaster ears, switch handle, side-wired screw terminals (and backwiring with clamp type terminals) and ground screw.
 - d. Pass & Seymour PS20AC2 series (see below for color).
3. Three-Way Toggle
 - a. "Specification grade" flush, quiet, AC-type, three-way toggle switches
 - b. 20-amperes, 277/125 volts AC, with mounting yoke insulated from mechanism
 - c. Plaster ears, switch handle, side-wired screw terminals (and backwiring with clamp type terminals).
 - d. Pass & Seymour series PS20AC3 (see below for color).
4. Four-Way Toggle
 - a. "Specification grade" flush, quiet, AC-type, four-way toggle switches
 - b. 20-amperes, 277/125 volts AC, with mounting yoke insulated from mechanism
 - c. Plaster ears, switch handle, side-wired screw terminals (and backwiring with clamp type terminals)
 - d. Pass & Seymour PS20AC4 series (see below for color).

2.03 DIMMERS

A. Controls

1. Dimmers shall provide full-range, continuously variable control of light intensity.
2. Controls shall fit a 1 inch wide, 1.5 inch tall wallplate opening with a vertical linear-slide. Controls shall be thin profile with no exposed heatsink/yoke. Unless otherwise specified, controls shall have a matte finish.
3. Controls shall provide a vertical slider allowing the light level or fan speed to be set by the user. "Slide-to-off" controls shall use the vertical slider to turn the control on and off.
4. "Preset" dimmers shall provide the on/off function independent of the dimmer slider position. This preset function shall be provided as a push on/push off switch integral to the slider knob and visibly distinct from the slider. For preset dimmers, when the lights are on, the slider shall change the light level and when the lights are off, the slider shall preselect the light level the lights will turn on to.
5. Control on/off function must be accomplished utilizing a mechanical air-gap switch to totally disconnect power from the load during "off" condition, no leakage current shall be present at the fixture(s).
6. Controls shall be able to have their visible plastic parts replaced, for color changes in the field, without removing the body of the control from the wall and without requiring special tools.

7. Within rated capacity, dimmers shall be available for direct control of incandescent, electronic low voltage, magnetic low voltage, and fluorescent. Matching fan-speed controls and switches shall also be available.
 8. Controls shall be capable of operating at the rated capacity; this includes modified capacities for ganging configurations which require the removal of fins. Operation at rated capacity shall be possible across the full ambient temperature range, without shortening design lifetime.
 9. Dimmer shall provide smooth and continuous Square Law dimming curve, for the full slider travel, on their rated load per The IESNA Lighting Handbook
 10. Controls shall meet the applicable requirements of UL 20 and UL 1472 referring to the inclusion of a visible, accessible air-gap off switch and the limited short circuit test.
 11. Dimmers shall be designed to reduce interference with radio, audio, and video equipment.
 12. Controls shall incorporate power-failure memory. Should power be interrupted and subsequently returned, the lights or fans will come back on to the same levels set prior to the power interruption. Restoration to some other default level is not acceptable.
 13. Dimmer shall include voltage compensation to compensate light output for variation in the AC line-voltage. Dimmers in which the light output is not held constant with varying AC line-voltage shall not be acceptable.
- B. Incandescent Dimmers
1. Provide incandescent dimmers for direct control of up to a full 20A lighting circuit, which is derated by 20% to 16 Amps per the NEC.
 2. Dimmers shall have a high-end of no less than 95% of line voltage.
 3. Dimmer shall be capable of operating in either 3-way switch location.
- C. Electronic (Solid-State) Low Voltage (ELV) Transformer Dimmers
1. Dimmers shall contain circuitry specifically designed to control the input of electronic (solid state) low voltage transformers. Dimmers using standard phase control shall not be acceptable.
 2. Provide ELV dimmers for direct control of up to 600 watts of electronic low voltage load.
 3. Dimmers shall have a high-end of no less than 90% of line voltage.
- D. Magnetic Low Voltage (MLV) Transformer Dimmers
1. Provide MLV dimmers for direct control of up to 1500VA of 120 volt magnetic low voltage load.
 2. Provide MLV dimmers for direct control of up to 1000VA of 277 volt magnetic low voltage load.
 3. Dimmers shall contain circuitry specifically designed to control and provide a symmetrical AC waveform to the input of magnetic low voltage transformers per UL1472 section 5.11.
 4. Dimmers shall not cause a magnetic low voltage transformer to operate above the transformers rated operating current or temperature.
 5. Dimmers shall have a high-end of no less than 95% of line voltage.
- E. Fluorescent Dimming Ballast Dimmers
1. Provide Fluorescent dimmers for direct control of fluorescent dimming ballasts up to the manufacturers specified rating.
 2. Dimmers shall be designed to provide full ballast output at high-end.
- F. Remote dimming modules for high power loads
1. Where lighting loads exceed the full rated capacity of single dimmers, provide an incandescent dimmer driving high power modules.

2. High power modules shall be remotely mounted.
3. High power module shall be rated and UL listed for control of incandescent, magnetic low voltage, electronic low voltage, fluorescent, and neon/cold cathode loads.

2.04 WIRING DEVICE ACCESSORIES

- A. Wall Plates: Provide wall plates for wiring devices, of types, sizes, and with ganging and cutouts as indicated on drawings (or schedules). Construct with metal screws with tamperproof heads for securing plates to devices, screw heads colored to match finish of plates. All aluminum plates shall be made of solid anodized aluminum (not painted aluminum). All plastic plates shall be high-impact, smooth nylon.

2.05 WIRING DEVICE FINISHES

- A. Provide device material and finish for outdoor locations, electrical rooms, mechanical rooms, work rooms, computer rooms, and equipment rooms according to the below list:
 1. Switches: White
 2. Switch Cover Plates: Nylon, White
 3. Receptacles: White
 4. Receptacle Cover Plates: Nylon, White
 5. Ground-Fault Interrupter: White
 6. Ground-Fault Interrupter Plates: Nylon, White
 7. Telephone Data Plates: Nylon, White
- B. Provide device material and finish for all other locations according to the below list:
 1. Switches: White
 2. Switch Cover Plates: Nylon, White
 3. Receptacles: White
 4. Receptacle Cover Plates: Nylon, White
 5. Ground-Fault Interrupter: White
 6. Ground-Fault Interrupter Plates: Nylon, White
 7. Telephone Data Plates: Nylon, White

PART 3 - EXECUTION

3.01 INSTALLATION OF WIRING DEVICES/PLATES

- A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting, electrical box and wiring work, as necessary to interface installation of wiring devices with other work, furniture locations, and door swings.
- C. Verify location of all devices with Architect before beginning construction.
- D. Install wiring devices only in electrical boxes which are clean, free from excess building materials, dirt, and debris.
- E. Install galvanized steel wall plates in unfinished spaces.
- F. Install weatherproof covers at all damp or exposed locations, as indicated on drawings.
- G. Delay installation of wiring devices until wiring work is completed.
- H. Delay installation of wall plates until after painting work is completed.
- I. Protect wiring devices during painting.
- J. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1/16" from the vertical or horizontal.

- K. All 20 amp and 15 amp, 3-wire receptacles shall be mounted with a "u" shaped grounding connection at the top, except for weatherproof receptacles and major appliance receptacles.
- L. Provide monolithic cover plate for all switches and dimmer switches adjacent to each other.

3.02 PROTECTION OF WALL PLATES AND RECEPTACLES

- A. Upon installation of wall plates and receptacles, advise Contractor regarding proper and cautious use of convenience outlets. At time of Substantial Completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.03 GROUNDING

- A. Provide electrically continuous, tight grounding connections for wiring devices, unless otherwise indicated. Tighten connections to comply with tightening torques specified in UL standard 486A to assure permanent and effective grounds.

3.04 TESTING

- A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level (within 1/16"). Mark all conductors with the panel and circuit number serving the device, at the device. Mark the panel and circuit number serving the device on the backside of the device plate with a permanent marking system that does not show through the front of the plate.

3.06 MOUNTING HEIGHTS

- A. Unless otherwise noted on the Drawings or required by the Architect, the following mounting heights shall apply:

Toggle switches	48" AFF	Vertical
Receptacles	18" AFF	Vertical
Over counter receptacles	6" Above Counter	Horizontal
Above back splashes	2" Above Splash Guard	Horizontal
Mechanical Room receptacles	18" AFF	Vertical
Receptacles above or adjacent to lavatories	42" AFF	Vertical
Receptacles behind domestic refrigerators	52" AFF	Vertical
Receptacles behind domestic washers	44" AFF	Vertical
Receptacles behind domestic dryers	44" AFF	Vertical
Receptacles behind domestic dishwashers	20" AFF	Vertical
Clock receptacles	Near ceiling or maximum 102" AFF	
Telephone outlets for wall mounted telephones	48" AFF	Vertical
Television receptacles and data outlets	96" AFF	Vertical
Data Outlets:	18" AFF	Vertical

- B. Upon approval of the Architect mounting heights may be adjusted.

END OF SECTION

SECTION 26 2813 FUSES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Fuses
- B. Related Sections include the following:
 - 1. Section 26 28 16 - Enclosed Switches and Circuit Breakers

1.02 SUBMITTALS

- A. Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.
- B. Product data for each fuse type. Include the following:
- C. Descriptive data and time-current curves.
 - 1. Let-through current curves for fuses with current limiting characteristics.
 - 2. Coordination charts and tables and related data.

1.03 QUALITY ASSURANCE

- A. Comply with NEC for components and installation.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
- C. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
- D. Single-Source Responsibility: All fuses shall be the product of a single manufacturer.

1.04 EXTRA MATERIALS

- A. Furnish the following extra materials that match products installed, packaged with protective covering for storage, and with identification labels clearly describing contents.
 - 1. Fuses: 1 for every 10 of each type and rating installed. Furnish at least 1 of each type and rating.

PART 2 - PRODUCTS

2.01 CARTRIDGE FUSES

- A. All fuses: 200,000 AIC at rated AC or DC voltage.
- B. Fuses 1/10 through 600 A
 - 1. UL Class: RK- 1, time delay
 - 2. Maximum operating temperature: 300 deg. F
 - 3. Self protecting thermally
 - 4. Separate overload and short circuit element
 - 5. Incorporate a spring-activated "snap-trigger" thermal overload element responsive to fuse temperatures exceeding 284 deg. F
- C. Fuses 601 to 6,000 A
 - 1. UL Class: L, time delay
 - 2. Pure silver links
 - 3. "O" ring seal
 - 4. 600V or less AC
 - 5. 250V or less DC

2.02 CONTROL CIRCUIT FUSES

- A. UL Class CC

- B. Dual element, time delay

2.03 PLUG FUSES

- A. Type: UL 198F, Type S, dual element, time delay
- B. Edison base fuses shall not be used

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install fuses in fusible devices as indicated. Arrange fuses so that fuse ratings are readable without removing fuse.

END OF SECTION

SECTION 26 2816
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Feeder and equipment disconnects
 - 2. Enclosed circuit breakers
- B. Related Sections include the following:
 - 1. Section 26 28 13 - Fuses

1.02 SUBMITTALS

- A. Product data for switches, circuit breakers, and accessories specified in this Section.
- B. Descriptive data and time-current curves for protective devices and let-through current curves for those devices with current-limiting characteristics. Include coordination charts and tables, and related data.

1.03 QUALITY ASSURANCE

- A. Comply with NEC for components and installation.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
- C. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
- D. Single-Source Responsibility: All enclosed switches and circuit breakers shall be the product of a single manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D
 - 2. Eaton
 - 3. ABB

2.02 MATERIALS

- A. ENCLOSED SWITCHES
 - 1. Enclosed Non-fusible Switch: NEMA KS 1, Type HD, handle lockable with 2 padlocks.
 - 2. Enclosed Fusible Switch, 800 Amperes and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position.
 - 3. Switches serving fire pumps: Shall be lockable in closed position.
 - 4. Enclosure: See plan.
- B. ENCLOSED CIRCUIT BREAKERS
 - 1. Enclosed Molded-Case Circuit Breaker: NEMA AB 1, handle lockable with 2 padlocks.
 - 2. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated; interrupting capacity rating to meet available fault current, 35,000 symmetrical RMS amperes minimum. With appropriate application listing when used for switching fluorescent lighting loads or heating, air conditioning, and refrigeration equipment.
 - 3. Interchangeable Trips: Circuit breakers, 200 amperes and larger, with trip units interchangeable within frame size.
 - 4. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.

5. Shunt Trip: Where indicated, 120 volts, 60 Hz.
6. Enclosure: See plan

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install enclosed switches and circuit breakers in locations as indicated, according to manufacturer's written instructions.
- B. Install enclosed switches and circuit breakers level and plumb.
- C. Install wiring between enclosed switches and circuit breakers and control and indication devices.
- D. Disconnects shall be mounted at 6'-6" AFF to top of enclosure in accessible areas, unless otherwise indicated.
- E. Fusible disconnects shall not be mounted over 12 feet AFF. Unless otherwise indicated.
- F. Disconnects mounted on equipment higher than 12 feet AFF, shall be non-fused. Fusing protection must be provided in a more readily accessible location.
- G. All motors shall have a disconnecting means within sight of, and not more than 20 feet from motor.
- H. Provide a "Lock-Out" means at disconnect for all motors, at disconnect nearest motor or equipment.
- I. Connect enclosed switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.02 FIELD QUALITY CONTROL

- A. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
- B. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA Standard ATS, Section 7.5 for enclosed switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
- C. Verify all interlock devices (mechanical and electrical) are in place and working correctly.
- D. Correct malfunctioning units at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

3.03 CLEANING

- A. After completing 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.

3.04 DEMONSTRATION

- A. Review data in the "Operating and Maintenance Manual." Refer to Division 01 Section "Closeout Procedures."

END OF SECTION

**SECTION 26 3213
ENGINE DRIVEN GENERATOR SYSTEM**

PART 1 - GENERAL

1.01 SUMMARY

- A. It is the intent of this specification to secure an engine driven generator system that has been prototype tested, factory built, production tested, and site tested, together with all options, accessories, and weather-proof enclosure necessary for a complete installation as specified herein.

1.02 GENERAL REQUIREMENTS

- A. The generator system will be of the listed commercial design and will be complete with all of the necessary accessories for complete installation as shown in specifications herein. The equipment supplied and installed shall meet the requirements of the National Electrical Code, along with all applicable local codes and regulations. All equipment shall be new and of current production of a national firm that manufactures the generator system and controls, transfer switches, switchgear, and assembles the generator system as a complete and coordinated system. There will be one source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.
- B. Generator shall meet NFPA 110, Type 10 requirements
- C. Generator shall meet the following performance requirements:
 - 1. Minimum 200 KW
 - 2. Minimum Starting KVA: 450 sKVA
 - 3. 208Y/120V, 3 Phase, 4 Wire, 0.8 PF

D. CODES AND STANDARDS

- 1. The generator system shall conform to the requirements of the following codes and standards:
 - a. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
 - b. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
 - c. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 - d. IEC 8528 part 4. Control Systems for Generator Sets
 - e. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
 - f. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 - g. NFPA 30 – Flammable and Combustible Liquids Code
 - h. NFPA 37 – Installation and Use of Stationary Combustion Engines and Gas Turbines
 - i. NFPA 70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
 - j. NFPA 110 – Emergency and Standby Power Systems.
 - k. UL2200 – Stationary Engine Generator Assemblies
 - l. ISO 8528 – Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets

1.03 SUBMITTALS

- A. Product Data: For each type of generator indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

- B. Shop Drawings: For each generator and related equipment.
1. Manufacturer's product literature for the engine-generator, turbocharger, aftercoolers, high temperature water heat exchanger, medium temperature water heat exchanger, engine starting system, battery rack, battery charger.
 2. Engine torque, brake horsepower and fuel consumption curves for the specified conditions.
 3. Outline drawings (plans and sections) for the complete engine generator set showing the location, size and other pertinent details of each electrical, piping and monitoring connection.
 4. Detailed installation plan drawing, showing the position of the engine generator and associated equipment and the location and size of all piping, instrument and electrical connections and devices.
 5. Weight of complete unit and weight of heaviest removable part.
 6. Vibration isolator information and catalog data.
 7. Foundation recommendations.
 8. Engine-generator block load acceptance and generator voltage drop and synchronization information.
 9. Engine cooling system equipment catalog information and design data for all pumps, heat exchangers and control valves.
 10. Complete details of all engine safety devices and pressure, temperature, vibration, and level switches.
 11. Allowed engine exhaust system backpressure, listed as inches W.C.
 12. Complete control diagrams and process and instrumentation diagrams relating to the submitted equipment. Complete wiring diagrams including schematic, connection and interconnection diagrams for the generator and accessories.
 13. Engine lube oil filter and oil cooler catalog data and information.
 14. Engine exhaust emission levels at 50-, 75- and 100-percent specified load for the following pollutants, expressed as grams per horsepower-hour:
 - a. NOx
 - b. CO
 - c. Non Methane Hydrocarbons (NMHC)
 - d. CH4

1.04 WARRANTY

- A. Special Warranty: A no deductible warranty shall be provided, by the manufacturer, for all products listed in this section. They shall be warranted against defects in materials and workmanship. The manufacturer's warranty shall be comprehensive and cover all parts, labor, travel time, and mileage charges, with the exception of consumable items, such as filters, belts, hoses, etc.
1. Warranty Period: 5 years from date of Substantial Completion.

1.05 MAINTENANCE SERVICE

- A. Maintenance Service: Provide maintenance by skilled employees of manufacturer's designated service organization. Include quarterly inspections and annual preventive maintenance as outlined below:
1. Maintenance Period: 1 year from date of Substantial Completion.
- B. Inspections:
1. Lubricating System

- a. Check for leaks
 - b. Check operation of oil heater
 - c. Check and record oil pressure
- 2. Cooling System
 - a. Check coolant level
 - b. Check for leaks
 - c. Check hose and connections
 - d. Check anti-freeze, DCA concentration
 - e. Check fan belts
 - f. Check fan hub and water pump
- 3. Heat exchanger anode plugs
 - a. Check radiator air restriction
 - b. Record operating temperatures
 - c. Check operation of coolant heater
- 4. Fuel System
 - a. Check leaks
 - b. Check fuel level
 - c. Check fuel lines and connections
 - d. Check float switches
- 5. Air System
 - a. Check piping, hose connections
 - b. Check air filter
 - c. Check for leaks
- 6. Exhaust System
 - a. Check for leaks
 - b. Drain condensate trap
- 7. Electrical System
 - a. Check operating alarms, safety devices and shutdown
 - b. Inspect, clean battery terminals
 - c. Check battery electrolyte
 - d. Check battery charging system
- 8. Governor
 - a. Check electronic gov. control
- 9. Engine Related
 - a. Tighten mounting hardware
 - b. Check for unusual vibration
- 10. Generator
 - a. Check operation strip heater
 - b. Clean vent screen
- 11. Switchgear
 - a. Operate circuit breaker
 - b. Check start switch in auto

12. Other checks
 - a. Exercise automatic crank system
 - b. Check overcrank
 - c. Check meter operation
 - d. Check transfer switch operation
- C. Preventive Maintenance
 1. Perform all items under Inspection above
 2. Change lubricating oil
 3. Change oil filters
 4. Change water filter
 5. Change fuel filters

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The generator manufacturer must have a service capability with the following requirements:
 1. Service Center within 100 mile radius of project
 2. Service Center must be a parts distributor with stocked inventory of generator spare parts
 3. Service Center must have been in business for a minimum of 5 years
 4. Service technician must be on site within 6 hours of call out
 5. Must be a sales, parts and service center. Must be available 24 hours a day, 7 days a week and an authorized distributor.
- B. Subject to compliance with requirements, provide products of one of the following:
 1. Cummins Power Generation
 2. MTU
 3. Generac Power Systems
 4. Kohler

2.02 GENERATOR

- A. The basic engine-generator specifications are listed in the summary. All other components are further specified. It shall provide specified kVA when operating at voltage, .8 power factor.
- B. The generator system shall be capable operating at full load in an ambient condition of 104°F.
- C. Maximum 30% voltage dip and a maximum 10% frequency dip at required sKVA per contract documents.
- D. The generator system rating shall be based on Emergency Service, Level 2, Type 10 and marked as such per NFPA 110.
- E. The generator system shall have the proper EPA stationary diesel generator set emissions for standby application.

2.03 ENGINE

- A. The engine shall have to deliver the horsepower rating to drive the alternator and all connected accessories at a governed speed of 1800 rpm (if another rpm is used, please document in submittal). The engine shall be equipped with the following:
 1. An electronic isochronous governor capable of steady-state frequency regulation.
 2. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and

excitation as appropriate to the state of the generator system. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous or parallel states.

3. 12 volt or 24 volt positive engagement solenoid shift-starting motor.
 4. Automatic battery charging alternator with solid-state voltage regulation
 5. Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
 6. Dry-type replaceable air cleaner elements for normal applications.
 7. Engine-driven or electric fuel transfer pump capable of lifting fuel 6 feet, fuel filters, and electric solenoid fuel shut-off valve.
 8. Electric starters capable of three complete cranking cycles without overheating.
 9. Positive displacement, mechanical, full pressure, lubrication oil pump.
 10. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.
 11. An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin-on canister element. Fuel cooler, suitable for operation of the generator system at full rated load in the ambient temperature specified shall be provided if required for operation due to the design of the engine and the installation.
 12. Replaceable dry element air cleaner with restriction indicator.
 13. Flexible supply and return fuel lines.
- B. The turbocharged engine shall be fueled with No. 2 diesel.
- C. There shall be an oil level regulator located within the generator enclosure
- D. The engine shall be liquid-cooled by a unit-mounted radiator, blower fan, water pump, and thermostats. This system shall properly cool the engine with up to 0.5 inches H₂O static pressure on the fan in an ambient temperature up to 122F/50C.
- E. The engine shall be EPA Tier Certified as specified per the horsepower rating.

2.04 ALTERNATOR

- A. The AC alternator shall be a permanent magnetic exciter, synchronous, 4 pole, 2/3 pitch, brushless, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. The alternator design shall prevent shaft current from flowing and eliminate the need for insulated bearings. All insulation system components shall meet NEMA MG1 requirements for Class H insulation systems.
- B. Actual temperature rise measured by resistance method at full load shall not exceed 130 degree Celsius in a 40 degree Celsius ambient. The generator system shall meet the transient performance requirements of ISO 8528-5, level G-2.
- C. Provide alternator heater.

2.05 CONTROLLER

- A. Set-mounted controller capable of facing right, left, or rear, shall be vibration isolated on the alternator enclosure. The microprocessor control board shall be moisture proof and capable of operation from -40°C to 85°C.
- B. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator system is overloaded. An AC over/under voltage monitoring system which responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator system when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

- C. Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall include the following features:
1. Fused DC circuit.
 2. Complete 2-wire start/stop control, which shall operate on closure of a remote contact.
 3. Speed sensing and a second independent starter motor disengagement systems shall protect against starter engagement with a moving flywheel. Battery charging alternator voltage will not be acceptable for this purpose.
 4. The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then re-engage the starter.
 5. Cranking cyler with 15-second ON and OFF cranking periods.
 6. Overcrank protection designed to open the cranking circuit after 75 seconds if the engine fails to start.
 7. Circuitry to shut down the engine when signal for high coolant temperature, low oil pressure, or overspeed are received.
 8. Engine cooldown timer factory set at 5 minutes to permit unloaded running of the standby set after transfer of the load to normal.
 9. 3-position (Automatic-OFF-TEST) selector switch. In the TEST position, the engine shall start and run regardless of the position of the remote starting contacts. In the Automatic position, the engine shall start when contacts in the remote control circuit close and stop 5 minutes after those contacts open. In the OFF position, the engine shall not start even though the remote start contacts close. This position shall also provide for immediate shutdown in case of an emergency. Reset of any fault shall also be accomplished by putting the switch to the OFF position.
 10. Alarm horn with silencer switch per NFPA 110.
- D. Standard indicating lights to signal, and digital display of the following shall be included:
1. Not-in-Auto (flashing red)
 2. Overcrank (red)
 3. Emergency Stop (red)
 4. High Engine Temperature (red)
 5. Overspeed (red)
 6. Low Oil Pressure (red)
 7. Battery Charger Malfunction (red)
 8. Low Battery Voltage (red)
 9. Low Fuel (red)
 10. Auxiliary Prealarm (yellow)
 11. Auxiliary Fault (red)
 12. System Ready (green)
- E. Test button for indicating lights.
- F. Terminals shall be provided for each indicating light above, plus additional terminals for common fault and common prealarm.

2.06 INSTRUMENT PANEL

- A. The instrument panel shall include the following:
1. Generator Set AC Output Metering: The generator set shall be provided with both an analog and digital metering set with the following features and functions:

- a. Color coded analog bar graph metering shall be provided to include voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. These meters shall be color coded in the following fashion: readings from 0-90% of generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.
 - b. Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.
- 2. Engine Status Monitoring: The following information shall be available from a digital status panel on the generator set control:
 - a. engine oil pressure (psi or kPA)
 - b. engine coolant temperature (degrees F or C; Both left and right bank temperature shall be indicated on V-block engines.)
 - c. engine oil temperature (degrees F or C)
 - d. engine speed (rpm)
 - e. number of hours of operation (hours)
 - f. number of start attempts
 - g. battery voltage (DC volts)

2.07 ACCESSORIES

- A. Include all accessories included in this specification and on the contract documents.
- B. Provide vibration isolation. Coordinate vibration isolation attachment to concrete pad.
- C. Exhaust Silencer: Provide exhaust silencer(s) as specified for each engine of size and type as recommended by the generator system manufacturer and approved by the engine manufacturer. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.
- D. Main Circuit Breaker: An 80% rated, main line circuit breaker of listed amperes, listed amps sensor, listed voltage, molded case type, generator mounted. Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Long and short time adjustable magnetic trip settings for circuit-breaker frame sizes 200 amp and larger. Auxiliary contacts will need to be included for switch position.
- E. Engine block heater: Thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA-99 and NFPA-110 of the Level and Type per the contract documents.
- F. Batteries: Batteries as required to meet the start-up and running requirements of NFPA-99 and NFPA-110 for the Level and Type per the contract documents.
- G. Battery Charger: 10-ampere minimum, automatic float and equalize battery charger with +/- 1% constant voltage regulation from no load to full load over +/-10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambient temperatures from -40°C to +60°C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected. Shall be sized appropriately for use with the generator set configuration and batteries.
- H. Fuel Lines: Two flexible fuel lines rated at a minimum of 257°F and 100 psi ending in pipe thread.
- I. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
 - 1. Overcrank shutdown.
 - 2. Coolant low-temperature alarm.

3. Control switch not in auto position.
 4. Battery-charger malfunction alarm.
 5. Battery low-voltage alarm.
- J. Remote Alarm Annunciator: Comply with NFPA 110. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition.
- K. Remote Manual Stop Station: Remote manual stop station meeting NFPA 110, Section 5.6.5.6 requirements located external to enclosure in a weatherproof enclosure side mounted to the generator's weather protective enclosure.

2.08 WEATHER PROTECTIVE ENCLOSURE

- A. Outdoor Weather-Protective Housing: The generator system shall be provided with a sound attenuated weather protective housing which allows the generator system to operate at full rated load in the ambient conditions previously specified.
- B. The enclosure shall be rated and certified, by the manufacturer to withstand winds up to 130 mph.
- C. The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. Key-locking and pad lockable door latches shall be provided for all doors.
- D. The sound enclosure shall have sound attenuated material (mechanical restrained) bird screens, stainless steel fasteners and lift off hinges, and powder coat finish. Sound attenuation with generator operating under full load shall have a 14dBa reduction average @ 23ft in free field. Hoods may be shipped loose for freight purposes and installed by contractor.
- E. The enclosure shall be provided with a critical grade radiator exhaust silencer mounted inside of the enclosure.
- F. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color. All surfaces of all metal parts shall be primed and electro statically or powder coated. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.
- G. A side/internal stub up area shall be provided for normal and load power cables. An external access panel may be needed on external enclosure for rear.

2.09 DOUBLE WALL SECONDARY CONTAINMENT SUB BASE FUEL TANK

- A. A sub base fuel tank used in conjunction with a diesel powered generator set will contain a minimum 690 gallons or 47 hours of run time at full load fuel to support the generator set.
- B. Upon substantial completion, the Contractor shall fill the tank with fuel.
- C. The sub base fuel system is listed under UL 142, sub section entitled Special Purpose Tanks EFVT category, and will bear their mark of UL Approval according to their particular classification.
- D. The above ground steel secondary containment rectangular tank for use as a sub base for diesel generators is manufactured and intended to be installed in accordance with the Flammable and Combustible Liquids Code—NFPA 30, the Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines—NFPA 37, and Emergency and Standby Power Systems—NFPA 110.
- E. Construction:
 1. Primary Tank: It will be rectangular in shape and constructed in clam shell fashion to ensure maximum structural integrity and allow the use of a full throat fillet weld.
 2. Steel Channel Support System: Reinforced steel box channel for generator support, with a load rating of 5,000 lbs. per gen set mounting hole location. Full height gussets at either end of channel and at gen set mounting holes shall be utilized.

3. Exterior Finish: The exterior coating has been tested to withstand continuous salt spray testing at 100 percent exposure for 244 hours to a 5 percent salt solution at 92-97F. The coating has been subjected to full exposure humidity testing to 100 percent humidity at 100F for 24 hours. Tests are to be conducted in accordance with The American Standard Testing Methods Society.
4. The tank may not exceed 150" in length and may not exceed 50" in width.
- F. Venting: Normal venting shall be sized in accordance with the American Petroleum Institute Standard No 2000, Venting Atmospheric and Low Pressure Storage Tanks not less than 1-1/4" (3 cm.) nominal inside diameter. A 1 -1/4" atmospheric mushroom cap shall be furnished and the installing contractor shall pipe above the highest fill point as a minimum
- G. Emergency Venting: The emergency vent opening shall be sized to accommodate the total capacity of both normal and emergency venting and shall be not less than that derived from NFPA 30, table 2-8, and based on the wetted surface area of the tank. The wetted area of the tank shall be calculated on the basis of 100 percent of the primary tank. A zinc plated emergency pressure relief vent cap shall be furnished for the primary tank. The vent is spring-pressure operated: opening pressure is 0.5/psig and full opening pressure is 2.5 psig. Limits are stamp marked on top of each vent. The emergency relief vent is sized to accommodate the total venting capacity of both normal and emergency vents.
- H. Fuel Fill: There shall be a 2" NPT opening within the primary tank with an 8" raised fill pipe and lockable manual fill cap.
- I. Fuel Level: A direct reading, UL listed, magnetic fuel level gauge with a hermetically-sealed vacuum tested dial shall be provided to eliminate fogging.
- J. Low Fuel Level Switch: Consists of a 50 watt float switch for remote or local annunciation of a (50% standard) low fuel level condition.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The generator shall be installed such that the sub base fuel tank is installed a minimum of 10 feet from the property line.

3.02 TESTING

- A. To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.
- B. Design Prototype Tests: Components of the emergency system such as the engine/generator system, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models shall be subject to the following tests.
 1. Maximum power (kW).
 2. Maximum motor starting (kVA) at 15% instantaneous voltage dip.
 3. Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.40.
 4. Governor speed regulation under steady-state and transient conditions.
 5. Voltage regulation and generator transient response.
 6. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
 7. Three-phase short circuit tests.
 8. Alternator cooling air flow.
 9. Torsional analysis to verify that the generator system is free of harmful torsional stresses.
 10. Endurance testing.

11. Provide labels and identification per NEC requirements and 26 05 53.

C. PRODUCTION TESTS

1. Final Production Tests: Each generator system shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
 - a. Single-step load pickup.
 - b. Transient and steady—state governing.
 - c. Safety shutdown device testing.
 - d. Voltage regulation.
 - e. Rated Power @ 0.8 PF
 - f. Maximum Power.
 - g. Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

D. SITE TESTS

1. Site Tests: An installation check, start-up, and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
 - a. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
 - b. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, alternator strip heaters, remote annunciator, etc.
 - c. Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and frequency, and phase rotation.
 - d. Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator system voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system if sufficient building load is unavailable to load the generator system to the nameplate kW rating.

3.03 DEMONSTRATION

A. Building Operating Personnel Training

1. Train Owner's building personnel in procedures for starting-up, testing and operating lighting control system equipment.
2. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. There will be a total of 2 training sessions. Provide at least 3 hours of training for each session.
 - a. Immediately after start-up of the equipment
 - b. At final walk through of the installation

END OF SECTION

SECTION 26 3623
AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.01 SUMMARY

- A. The work of this section consists of providing labor, materials, tools, appliances and miscellaneous accessories associated with automatic transfer switch work indicated on the Drawings and schedules. This specification is not intended for the automatic transfer switch serving the fire pump.

1.02 SUBMITTALS

- A. Shop Drawings
 - 1. Manufacturer's product literature
 - 2. Outline drawings (plans and sections) showing the location, size and other pertinent details of each electrical, piping and monitoring connection.
 - 3. Weight of complete unit and weight of heaviest removable part.
 - 4. Complete control diagrams and process and instrumentation diagrams relating to the submitted equipment. Complete wiring diagrams including schematic, connection and interconnection diagrams for the generator and accessories.

1.03 QUALITY ASSURANCE

- A. 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.
- B. Comply with all applicable standards below:
 - 1. NEMA ICS 1
 - 2. NFPA 70
 - 3. NFPA 110
 - 4. UL 1008
 - 5. IBC
 - 6. IEEE446
 - 7. NEMA ICS10-1993
 - 8. IEC

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The transfer switch manufacturer must have a service capability with the following requirements:
 - 1. Service Center within 100 mile radius of project
 - 2. Service Center must be a parts distributor with stocked inventory of generator spare parts
 - 3. Service Center must have been in business for a minimum of 5 years
 - 4. Service technician must be on site within 6 hours of call out
 - 5. Must be a sales, parts and service center. Must be available 24 hours a day, 7 days a week and an authorized distributor.
- B. Subject to compliance with requirements, provide products of one of the following:
 - 1. Cummins Power Generation
 - 2. MTU
 - 3. Generac Power Systems

4. Eaton

2.02 GENERAL

- A. The automatic transfer switch shall be listed by UL 1008 with circuit breaker protection. Representative production samples of the transfer switch supplied shall have demonstrated through tests the ability to withstand at least 10,000 mechanical operation cycles. One operation cycle is the electrically operated transfer from normal to emergency and back to normal. Wiring must comply with NEC table 373-6(b). The manufacturer shall furnish schematic and wiring diagrams for the particular automatic transfer switch and a typical wiring diagram for the entire system.

2.03 RATINGS & PERFORMANCE

- A. The automatic transfer switch shall be a 3 pole design rated for (see drawings for ratings) amperes continuous operation in ambient temperatures of -20 Degrees Fahrenheit (-30 Degrees Celsius) to +140 Degrees Fahrenheit (+60 Degrees Celsius).
- B. Main power switch contacts shall be rated for 600 Volt AC minimum.
- C. Tested Fault-Current Closing and Short-Circuit Ratings: The transfer switch(es) supplied shall have adequate duty imposed by protective devices at installation locations in Project under the fault conditions indicated on the drawings, based on testing according to UL 1008. Transfer switch equipment shall have withstand and closing ratings (WCR) in RMS symmetrical amperes greater than the available fault currents shown on the drawings and at the specified voltage. These RMS symmetrical fault current ratings shall be the rating listed in the UL listing or component recognition procedures for the transfer switch.

2.04 CONSTRUCTION

- A. The transfer switch shall be double throw construction, positively electrically and mechanically interlocked to prevent simultaneous closing and mechanically held in both normal and emergency positions. The transfer switch shall use delayed transition with programmable transition time. The electrical operating means shall be by electric solenoid. Every portion of the contactor is to be positively mechanically connected. No clutch or friction drive mechanism is allowed, and parts are to be kept to a minimum. This transfer switch shall not contain integral overcurrent devices in the main power circuit, including molded case circuit breakers or fuses.
- B. Buss shall be copper plated.
- C. The transfer switch operation shall include the ability to switch to an open position (both sources disconnected) for the purpose of load shedding from the generator set.
- D. The transfer switch electrical actuator shall have an independent disconnect means to disable the electrical operation during manual switching. Maximum electrical transfer time in either direction shall be 160 milliseconds, exclusive of time delays. Main switch contacts shall be high-pressure silver alloy contacts with arc chutes to resist burning and pitting for long life operation. Switches rated at 600 amps or larger shall also have arcing contacts.
- E. The transfer switch shall have a digital display to provide a convenient method for monitoring load power conditions, adjusting transfer switch parameters, monitoring network status, or reviewing switch events.

2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents
 - 1. 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.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

- a. Instantaneous trip
 - b. Long- and short-time pickup levels
 - c. Long- and short-time time adjustments
- 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles
 - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Undervoltage Trip: Set to operate at 35 to 75 percent of rated with field-adjustable 0.1- to 0.6-second time delay.
 - 4. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

2.06 CONTROLS

- A. All control equipment shall be mounted on the inside of the cabinet door in a metal lockable enclosure with transparent safety shield to protect all solid state circuit boards. This will allow for ease of service access when main cabinet lockable door is open, but to prevent access by unauthorized personnel. Control boards shall have installed cover plates to avoid shock hazard while making control adjustments. The solid state voltage sensors and time delay modules shall be plug-in circuit boards with silver or gold contacts for ease of service.
- B. A utility sensing interface shall be used for all solid state controls, stepping down system voltage to 24 volts or 12 volts, helping to protect the printed circuit board from voltage spikes and increasing personnel safety when troubleshooting.
- C. Provide bright lamps to indicate the transfer switch position in either UTILITY (white) or EMERGENCY (red). A third lamp is needed to indicate STANDBY OPERATING (amber). These lights must be energized from utility or the engine-generator set. Front mounted controls shall include a selector switch to provide for a NORMAL TEST mode with full use of time delays, FAST TEST mode which bypasses all time delays to allow for testing the entire system, or AUTOMATIC mode to set the system for normal operation.
- D. Provide manual operating handle to allow for manual transfer. This handle must be mounted inside the lockable enclosure so accessible only by authorized personnel.
- E. Provide a safety disconnect switch to prevent load transfer and automatic engine start while performing maintenance. This switch will also be used for manual transfer switch operation.
- F. Provide LED status lights to give a visual readout of the operating sequence. This shall include utility on, engine warm-up, standby ready, transfer to standby, in-phase monitor, time delay neutral, return to utility, engine cooldown and engine minimum run. A "signal before transfer" lamp shall be supplied to operate from optional circuitry.
- G. There shall be 2 SPDT (form C), 10 ampere, 250 volt auxiliary contact on both normal and emergency sides, operated by the switch mechanism for monitoring switch position. Full rated neutral bar (or contacts on switched neutral applications) with lugs for normal, emergency and load conductors shall be provided inside the cabinet.
- H. The transfer switch mechanism and controls are to be mounted in a lockable enclosure.

2.07 CONTROL OPTIONS

- A. A solid state undervoltage sensor shall monitor all phases of the normal source and provide adjustable ranges for field adjustments for specific application needs. Pick-up settings shall be adjustable from a minimum of 85% to a maximum of 97% of nominal voltage. Drop-out settings

shall be adjustable from a minimum of 75% to a maximum of 97% of nominal voltage. Drop-out time delay setting shall be adjustable from a minimum of 0.1 seconds to 1 second.

- B. A solid state overvoltage sensor shall monitor all phases of the normal source and provide adjustable ranges for field adjustments for specific application needs. Pick-up settings shall be adjustable from a minimum of 95% to a maximum of 98% of nominal voltage. Drop-out settings shall be adjustable from a minimum of 105% to a maximum of 135% of nominal voltage. Drop-out time delay setting shall be adjustable from a minimum of 0.5 seconds to 90 seconds.
- C. A solid state over/under frequency sensor shall monitor all phases of the normal source and provide adjustable ranges for field adjustments for specific application needs. Pick-up and drop-out settings shall be adjustable from a minimum of 5% to a maximum of 20% of nominal frequency. Drop-out time delay setting shall be adjustable from a minimum of 0.1 seconds to a maximum of 10 seconds.
- D. A solid state voltage imbalance sensor shall monitor all phases of the normal source and provide adjustable ranges for field adjustments for specific application needs. Drop-out settings shall be adjustable from a minimum of 2% to a maximum of 10% of nominal voltage. Drop-out time delay setting shall be adjustable from a minimum of 2 seconds to 15 seconds.
- E. The transfer switch shall have a time delay neutral feature to provide a time delay, adjustable from .1-10 seconds, during the transfer in either direction, during which time the load is isolated from both power sources. This allows residual voltage components of motors or other inductive loads (such as transformers) to decay before completing the switching cycle. A switch will be provided to bypass all transition features when immediate transfer is required.
- F. The transfer switch shall have an in-phase monitor which allows the switch to transfer between live sources if their voltage waveforms become synchronous within 20 electrical degrees within 10 seconds of transfer initiation signal. A switch must be provided to bypass this feature if not required. If the in-phase monitor will not allow such a transfer, the control must default to time delay neutral operation. Switches with in-phase monitors which do not default to time delay neutral operation are not acceptable.

2.08 SEQUENCING

- A. Signal the engine-generator set to start in the event of a power interruption. A set of contacts shall close to start the engine and open for engine shutdown. A solid state time delay start, adjustable, .1 to 10 seconds, shall delay this signal to avoid nuisance start-ups on momentary voltage dips or power outages.
- B. The transfer function shall be inhibited by the system controller until sufficient electrical power is available. The transfer switch logic will monitor the emergency system voltage and frequency. When the voltage and frequency are stable, the transfer function will be initiated. A solid state time delay, adjustable from 5 seconds to 3 minutes, shall delay the transfer to allow the engine-generators to warm-up before application of load. There shall be a switch to bypass this warm-up timer when immediate transfer is required.
- C. Retransfer the load to the line after normal power restoration. A return to utility timer, adjustable from 1-30 minutes, shall delay this transfer to avoid short term normal power restoration.
- D. The operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred. Controls shall provide an automatic retransfer of the load from emergency to normal if the emergency source fails with the normal source available.
- E. Signal the engine-generator to stop after the load retransfers to normal. A solid state engine cooldown timer, adjustable from 1-30 minutes, shall permit the engine to run unloaded to cooldown before shutdown. Should the utility power fail during this time, the switch will immediately transfer back to the generator.
- F. Provide an engine minimum run timer, adjustable from 5-30 minutes, to ensure an adequate engine run period.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Floor-Mounting Switch: Anchor to floor by bolting.
- B. Set field-adjustable intervals and delays, relays, and engine exerciser clock.
- C. Ground equipment according to Section 26 05 26
- D. Connect wiring according to Section 26 05 19
- E. Provide labels and identification per NEC requirements and 26 05 53.

3.02 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
- C. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- D. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
- E. Check for electrical continuity of circuits and for short circuits.
- F. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
- G. Verify that manual transfer warnings are properly placed.
- H. Perform manual transfer operation.
- I. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
- J. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
- K. Simulate loss of phase-to-ground voltage for each phase of normal source.
- L. Verify time-delay settings.
- M. Verify pickup and dropout voltages by data readout or inspection of control settings.
- N. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
- O. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
- P. Verify grounding connections and locations and ratings of sensors.
- Q. Coordinate tests with tests of generator and run them concurrently.
- R. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- S. Remove and replace malfunctioning units and retest as specified above.
- T. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
- U. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

3.03 DEMONSTRATION

- A. Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and operating equipment. Provide at least 3 hours of training.
- B. Coordinate this training with that for the generator equipment.

END OF SECTION

**SECTION 26 4113
LIGHTNING PROTECTION SYSTEM**

PART 1 - GENERAL

1.01 SUMMARY

- A. Objective: To provide safety for the building and occupants by preventing damage to building structure caused by lightning.

1.02 CODES AND STANDARDS

- A. Standards: The following specifications and standards of the latest issue form a part of this specification:
 - 1. Lightning Protection Institute Installation Standard, LPI 175
 - 2. National Fire Protection Association Lightning Protection Standard, NFPA 780
 - 3. Underwriters Laboratories, Inc. Installation Requirements, UL96A

1.03 SYSTEM DESIGN

- A. The work covered by this section of the specifications consists of furnishing all labor, materials, and items of service required for the completion of a functional and unobtrusive lightning protection system and in strict accordance with this section of the specifications and the applicable contract drawings.
- B. If any departure from the contract drawings or submittal drawings covered below are deemed necessary by the Contractor, details of such departures and reasons therefore shall be submitted as soon as practical to the Architect for approval.

1.04 SUBMITTALS

- A. Product Data: For air terminals and mounting accessories.
- B. Shop Drawings: Detail lightning protection system, including air-terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.

1.05 QUALITY ASSURANCE

- A. The lightning protection system shall conform to the requirements and standards for lightning protection systems of the LPI, UL, and NFPA. Upon completion, an application shall be made to the Underwriters Laboratories, Inc. for inspection and certification and shall be delivered to the owner ensuring that the concealed components have also been monitored during job progress.
- B. The system to be furnished under this specification shall be the standard product of manufacturers regularly engaged in the production of lightning protection equipment and shall be the manufacturer's latest approved design. The equipment shall be UL listed and properly UL labeled.
- C. All equipment shall be new and of a design and construction to suit the application where it is used in accordance with accepted industry standards and LPI, UL, and NFPA code requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advanced Lightning Technology
 - 2. East Coast Lightning Equipment
 - 3. Thompson Lightning Protection

2.02 LIGHTNING PROTECTION EQUIPMENT

- A. Lightning Protection Equipment: All materials shall be copper, aluminum, or bronze and of the size, weight, and construction to suit the application and used in accordance with LPI, UL, and NFPA code requirements. Class I sized components may be utilized on roof levels 75 feet and below in height. Class II sized components are required for roof levels over 75 feet in height. Bolt type connectors and splicers shall be utilized on Class I and Class II structures. Pressure squeeze clamps are not acceptable. All mounting hardware shall be stainless steel to prevent corrosion.
- B. Aluminum Components: Aluminum materials may not be used except on roofs that utilize aluminum, galvalume or galvanized metal roofing components. On aluminum, galvalume or galvanized metal roofs or where aluminum, galvalume or galvanized metal parapet caps exist, the entire roof lightning protection equipment shall utilize aluminum components to insure compatibility. However, the down leads and grounding are to utilize copper with the bimetal transition occurring at the through roof assembly with an approved bimetal through roof assembly.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The installation shall be accomplished by an experienced installation company that is UL listed, a member of the Lightning Protection Institute and an employer of Certified Master Installers of lightning protection systems. A Certified Master Installer shall directly supervise the work. All equipment shall be installed in a neat, workmanlike manner. The system shall consist of a complete conductor network at the roof and include air terminals, connectors, splicers, bonds, copper down leads, and proper ground terminals. Copper down lead conductors shall be utilized even when aluminum is required on the roof. Down lead conductors in conduit shall not be brought directly through the roof. Through roof assemblies with solid brass or stainless steel rods shall be utilized. Structural steel may be utilized in the installation as outlined by UL, NFPA, and LPI.
- B. Coordination: Ensure a correct, neat and unobtrusive installation. The Contractor will be responsible for sealing and flashing all lightning protection roof penetrations as per the roof manufacturer's recommendations. However, the Contractor will be required to coordinate locations of through roofs and submit details of through roof penetrations as required. The Contractor shall use a compatible adhesive to adhere lightning protection components to the roof when required. Contractor to assure a sound bond to the main water service and to assure interconnection with other ground systems. Photos shall be submitted to the Architect of the bonds to the main water service.
- C. Completion: Upon completion of the installation, the Contractor shall secure and deliver to the Architect the Underwriters Laboratories, Inc. Master Label certification.

END OF SECTION

**SECTION 26 5000
LIGHTING**

PART 1 - GENERAL

1.01 SUMMARY

- A. Extent, location, and details of interior lighting fixture work are indicated on drawings and in schedules.

1.02 PRIOR APPROVALS

- A. For prior approvals, submit all requirements specified in Section 1.3. To be considered an equal fixture, the fixture must meet all criteria specified on the fixture schedule.
- B. Submit point to point calculations for all fixtures installed in private offices, open offices, corridors, and stack areas. Point to points shall use the following criteria:
 - 1. Light loss factor: 0.9
 - 2. Corridor calculation above finished floor: 0"
 - 3. Office calculation above finished floor: 32"
 - 4. Ceiling reflectance: 80%
 - 5. Wall reflectance: 50%
 - 6. Floor reflectance: 20%
- C. Submit parking lot point to point calculations. Calculations shall meet the following:
 - 1. Light loss factor 0.9
- D. Any proposed substitute must be submitted with proper documentation as noted in this specification along with a working sample at no charge at least 7 days prior to the bid date for approval.

1.03 SUBMITTALS

- A. Product data shall be submitted as a paper copy, in booklet form, in alphanumeric order, by fixture type.
- B. All submittals shall match exactly the style, design, and appearance of the fixtures specified in the fixture schedule and details of the drawings in order to be considered for substitution as an approved equal.
- C. Product Data: Submit manufacturer's product data and installation instructions on each type interior building lighting fixture and component. Include data on features, accessories, finishes, warranty, and the following:
 - 1. Photometrics
 - a. Coefficients of utilization
 - b. Candlepower data presented graphically and numerically
 - c. Zonal lumens
 - d. Efficiency
 - 2. Materials and dimensions of luminaires and mounting accessories.
 - 3. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric performance per IES LM-79-08 and LM-80-08.
 - 4. Luminaire ballasts, drivers, transformers, and other components necessary for operation.
 - 5. Photocell
- D. Shop Drawings: Fixture shop drawings with ballast manufacturer information in booklet form with separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet. Submit details

indicating compatibility with ceiling grid system. Submit locations of remote ballasts when specified.

- E. Samples for Verification: For lighting units or luminaires designated for sample submission in the Fixture Schedule shown on the drawings or for fixtures being submitted for prior approval:
 - 1. Lamps or LED Modules: Specified units installed.
 - 2. Ballast or Driver: 120-V model of specified ballast or driver type.
 - 3. Finishes: For each finished metal used in support components.
 - 4. Product Certificates: Signed by manufacturers of lighting units certifying that products comply with requirements.
 - 5. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
 - 6. Maintenance Data: For lighting units to include in maintenance manuals specified in Division 1.
- F. Light fixture submittals requiring a resubmittal shall only have the light fixtures that were marked with comments be resubmitted. Light fixtures in previous submissions that were not marked with comments will not be rereviewed unless the Contractor states in writing why that light fixture was resubmitted (fixture has changed, etc).
- G. Parking Lot Point To Point: Submit point to point calculations of the entire parking lot using the submitted fixtures. Illuminance calculations shall be done with minimum 10' by 10' point spacing using a light loss factor of 0.900. Calculations shall be done on the horizontal plane at grade and on the vertical plane from grade to 6'-0" above grade with the following statistical categories:
 - 1. Average
 - 2. Max
 - 3. Min
 - 4. Avg/Min
 - 5. Max/Min

1.04 QUALITY ASSURANCE

- A. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects with interior lighting fixture work similar to that required for this project.
- B. Codes and Standards
 - 1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Articles 220, 410, and 510 as applicable to installation, and construction of interior building lighting fixtures.
 - 2. NEMA Compliance: Comply with applicable requirements of NEMA LE 1 and LE 2 pertaining to lighting equipment.
 - 3. IES Compliance: Comply with IES RP-1 pertaining to office lighting practices and RP-15, regarding selection of illuminance values for interior office lighting.
 - 4. UL Compliance: Comply with UL standards, including UL 486A and B, pertaining to interior lighting fixtures. Provide interior lighting fixtures and components which are UL-listed and labeled.
 - 5. CBM Labels: Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.
 - 6. NSF Compliance: Provide fixtures compliant with NSF-2 where specified.
 - 7. IEC 60598: Provide IP ratings per IEC 60598-1 where specified.

- C. Coordination of Fixtures with Ceiling and exposed structure areas: Coordinate fixtures mounting hardware and trim with the ceiling system.
- D. Manufacturers Qualifications: Firms experienced in manufacturing fixtures that are similar to those indicated for this Project and that have a record of successful in-service performance.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver interior lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from damage.
- B. Store interior lighting fixtures in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, laid flat and blocked off ground.
- C. Handle interior lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.06 WARRANTY

- A. Special Warranty for luminaires and poles exhibiting a failure of finish as specified below.
 - 1. Protection of Metal from Corrosion: Warranty against perforation or erosion of finish due to weathering.
 - 2. Color Retention: Warranty against fading, staining, and chalking due to effects of weather and solar radiation
 - 3. Warranty Period: 5 years from date of Substantial Completion.
- B. Special Warranty for Ballasts, Drivers, and Emergency Battery Packs: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Ballasts, Drivers, and Emergency Batter Packs: 5 years from date of Substantial Completion.
- C. Special Warranty for LED modules: Manufacturer's standard form in which LED manufacturer agrees to repair or replace LED modules that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for LED modules: 5 years from date of Substantial Completion.
- D. Special Warranty for Small Inverters: Manufacturer's standard form in which manufacturer agrees to repair or replace inverters that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Small Inverters: 3 years on the electronics and battery and a 7 year pro-rata warranty on the battery from date of Substantial Completion.

1.07 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps or LED Modules: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Ballasts of Drivers: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 4. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Certain items in this Specification are listed by manufacturer and/or manufacturer's model number to establish general style, type, character and quality of the product desired. Similar items manufactured by other than those listed will be considered, providing submittals are made according to Pre-Bid Approval requirements of Instructions to Bidders.
- B. All lamps of the different types (fluorescent, LED, etc.) shall be by the same manufacturer.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work are listed on the lighting fixture schedule and the following:
 - 1. Light Fixtures: See fixture schedule
 - 2. LED Drivers:
 - a. Advance/Philips
 - b. General Electric
 - c. National Semiconductor
 - d. Osram Sylvania
 - 3. Light Emitting Diodes:
 - a. CREE
 - b. General Electric
 - c. Nichia
 - d. Phillips Lumileds
 - e. Osram Sylvania
 - 4. Emergency Battery Packs
 - a. Iota
 - b. Bodine
 - c. Assurance Emergency Lighting
 - 5. Small Inverters <600W
 - a. Iota
 - b. Bodine
 - c. Isolite
 - d. Assurance Emergency Lighting

2.02 FIXTURES

- A. Comply with the requirements specified in the Articles below and lighting fixture schedule.
- B. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy-efficient lamps, lamp holders, reflectors, energy efficient ballasts, starters and wiring. Ship fixtures factory-assembled, with parts required for a complete installation. Design fixtures with concealed hinges and catches, with metal parts grounded as common unit, and so constructed as to dampen ballast generated noise.
- C. Metal Parts: Free from burrs, sharp edges, and corners.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internals Access: Smooth operating and free from light leakage under operating conditions. Arrange to permit re-lamping without use of tools, except where

specified to be tamper resistant. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during re-lamping and secured in the operating position.

- G. Exposed Hardware Material: Stainless steel finished to match luminaire.
- H. Lenses, Diffusers, Covers, and Globes: 100 percents virgin acrylic plastic or water white, annealed crystal glass except as indicated.
 - 1. Plastic: Highly resistant to yellowing and other changes due to aging, exposure to heat and UV radiation.
 - 2. Lens Thickness: 0.125 inches, minimum
- I. Photoelectric Relays: As follows when indicated in luminaires:
 - 1. Contact Relays: Single throw, arranged to fail in the on position and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay.
 - 2. Relay Mounting: In luminaire housing
- J. Finish: As follows except as indicated:
 - 1. Pretreatment: Minimum 5-stage
 - 2. Powder Coat: Electrostatically applied baked on textured acrylic enamel except as indicated. Two coats minimum. Color as indicated.
- K. Electrostatically applied baked on textured acrylic enamel except as indicated. Color as indicated.

2.03 SUSPENDED FIXTURE SUPPORT COMPONENTS

- A. Rod Hangers: 3/16 inch diameter cadmium plated, threaded steel rod.
- B. Hook Hanger: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking type plug.

2.04 INCANDESCENT FIXTURES

- A. Conform to UL 1571, "Incandescent Lighting Fixtures."

2.05 LIGHT EMITTING DIODE (LED) FIXTURES

- A. Light Emitting Diode Luminaire:
 - 1. Provide LED fixtures complete with LED module, aluminum heat sink, drivers, base, pole, and other accessories as shown in drawings.
 - 2. Fixture shall be completely designed based on LEDs and not designed around an LED-based lamp meant to install into an existing fixture. Retrofit LED lamp/module into an existing fixture shall not be allowed.
 - 3. Aluminum Heat Sinks: All LED luminaires shall have an aluminum heat sink integral to fixture housing and designed for proper electrical bonding of LED module to allow maximum heat dissipation and to provide thermal management within the allowable operating range of the LED as specified by the LED manufacturer. The junction temperature (Tj) of each LED shall not exceed the maximum junction temperature specified in the manufacturer's product data sheet.
 - 4. Unless noted otherwise on the drawings, LEDs installed in each fixture shall be of the type specifically recommended by the manufacturer of the fixture for use in the fixture.
- B. Light Emitting Diode System Drivers:
 - 1. Provide LED system drivers, of ratings, types and makes as recommended by LED manufacturer. Driver for LED systems shall be electronic, 1 phase, 60 hertz, high power factor, constant current, electronic, low noise level, a minus 40 deg C temperature rating, and shall be furnished by the manufacturer of each type or particular lighting fixture specified.

2. Driver shall have a Class A sound rating.
3. Driver shall have a guaranteed minimum power factor of 0.90. (PF = Watts/Volt-Amps).
4. Driver shall be installed inside an electrical enclosure. Wiring inside electrical enclosure shall comply with 600V/105degC rating or higher.
5. Driver shall be available in a plastic/metal can or all metal can construction to meet all plenum requirements.
6. Driver shall be provided with poke-in wire trap connectors or integral leads color coded per ANSI C82.11.
7. Driver shall comply with UL standard UL1012
8. Driver shall have a rated lifetime of 50,000 hours
9. Driver shall operate from 60 Hz input source of 120 to 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the Driver
10. Driver output shall be regulated to +/- 5% across published load range.
11. Driver input current shall have Total Harmonic Distortion (THD) of less than 20%
12. Driver shall reduce output power to LEDs if its case temperature exceeds 85C – thermal protection.
13. Driver shall tolerate sustained open circuit and short circuit output conditions without damage and without need for external fuses or trip devices
14. Driver shall be IP64 rated except as indicated.
15. Driver shall not contain PCBs.
16. Driver shall comply with ANSI C62.41 Category A for Transient protection.
17. Driver shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR parth 15, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).
18. Driver shall be manufactured in a factory certified to ISO 9002 Quality System Standards.
19. Driver shall carry a five-year manufacturer's warranty from date of manufacture against defects in material or workmanship, including replacement, for operation at a maximum case temperature of 90C.
20. Driver manufacturer shall have a fifteen year history of producing electronic drivers for the North American market.

C. Light Emitting Diode System Module: LED Modules shall be of the type, color, and optical distribution indicated, as shown, and scheduled

1. LEDs shall be handled and soldered to printed circuit boards (PCBs) according to the manufacturers specifications.
2. LEDs shall produce a white light of the color temperature shown on the Fixture Schedule located on the drawings and not less than 75CRI value on the color rendering index.
3. LEDs shall be high brightness and high output.
4. LED performance and lumen maintenance testing shall be performed in accordance with IES LM-79-08 and LM-80-08.
5. LEDs shall provide approximately 50,000 hours of lighting at a level not less than 70% of initial lumen output.
6. LEDs shall operate from 60 Hz input source of constant 350mA with sustained variations of +/- 10% (current and frequency) with no damage to the LEDs.
7. LED lumen output shall be regulated to meet or exceed the published standard minimum luminous flux.

8. LEDs shall be within +/- 200K of specified color temperature shown in Fixture Schedule on drawings and shall be from the same bin.
9. LED manufacturer shall utilize strict binning and labeling techniques to ensure consistent brightness within +6 lm of published standard luminous flux and consistent chromaticity within +/-200K of specified color temperature per bin. Each bin shall be labeled with appropriate bin code relative to luminous flux and chromaticity.
10. LEDs shall have a minimum operating temperature of -40C.
11. LEDs shall be environmentally friendly, contain no mercury, lead or other heavy metals, and manufactured in compliance with RoHS and REACH.
12. LEDs and associated components of the LED Modules shall be manufactured in a factory certified to ISO 9002 Quality System Standards.
13. LEDs and associated components of the LED Modules shall carry a five-year manufacturer's warranty from date of manufacture against defects in material or workmanship, including replacement, for operation within specified system design parameters.
14. LED manufacturer shall have a fifteen year history of producing LEDs for the North American market.

2.06 TRACK LIGHTING SYSTEMS

- A. Conform to UL 574, "Track Lighting Systems." Provide components, including track, fittings, and fixtures from same manufacturer, and as recommended by the manufacturer for the intended purpose.

2.07 SITE LIGHTING POLES

- A. All site poles shall have a wind rating of 130 MPH with a 1.3 gust factor.

2.08 LED MODULES

- A. Provide all lamps as listed in the fixture schedule on the drawings or as described here under.
- B. Tested to LM-79 and LM-80.
- C. Minimum lamp life ratings (hours): TM-21 life at 60,000 hours up to L94.
- D. Minimum efficacy: 105 lm/watt

2.09 EMERGENCY BATTERY PACKS

- A. Self test and self diagnostic
- B. Minimum Emergency Lumen Output:
 1. Compact Fluorescent:
 - a. 1-lamp: 500 lumens
 - b. 2-lamp: 1100 lumens
 2. Linear Fluorescent: 1100 Lumens
 3. LED Troffer: 1100 Lumens
 4. LED Downlights
 - a. <1000 Lumens: 500 lumens
 - b. 1000 – 2000 Lumens 1000 lumens
- C. Run time: 90 minutes
- D. Batteries: Nickel Cadmium or Lithium

2.10 SMALL INVERTERS (<600W)

- A. UL 924 Listed

- B. Self test and self diagnostic, fully automatic, thermal-compensating variable-rate battery charger with AC lookout, and low battery voltage disconnect
- C. Stand alone sine wave output
- D. Compatible with incandescent, LED, and fluorescent
- E. Allows for normally on, normally off, switched, or dimmed controls without affecting fixture operation during a power failure. Upon power failure the inverter shall deliver 100% output regardless of the local switch or dimmer position.
- F. Run time: 90 minutes
- G. Batteries: Valve Regulated Lead Acid, Nickel Cadmium, or Lithium
- H. Remote mountable up to 1000 feet from light fixture being served

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures. Notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. Install interior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.
- B. Setting and Securing: Set units plumb, square, and level with ceiling and walls, and secure according to manufacturers printed instructions and approved shop drawings.
- C. Recessed Fixtures: Installed units may be supported from suspended ceiling support system. Install ceiling system support rods or wires at a minimum of four rods or wires per fixture located not more than 6 inches from fixture corners.
 - 1. Fixtures Smaller Than Ceiling Grid: Install a minimum of four rods or wires for each fixture and locate at corner of the ceiling grid where the fixture is located. Do not support fixtures by ceiling acoustical panels.
 - 2. Fixtures of Sizes Less than Ceiling Grid: Center in the acoustical panel. Support fixtures independently with at least two ¾ inch metal channels spanning and secured to the ceiling tees.
 - 3. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corners.
- D. Light fixtures in suspended ceiling systems shall be positively attached to the ceiling system using screws or manufacturer supplied clips, in accordance with manufacturer written instructions. When using screws avoid bending fixture frame. Minimum of four attachment points, additional if required.
- E. Light fixtures in suspended ceiling systems shall be connected with a flexible wiring method. Provide additional length to allow the fixture to be moved two feet in any direction.
- F. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by Architect.
- G. Install flush mounted fixtures to eliminate light leakage between fixture frame and finished surface.
- H. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.

- I. For air supply type fixtures, retain side slot closures in place for adjustment by Balancing Contractor.
- J. Fasten fixtures securely to indicated structural supports; and ensure that pendant fixtures are plumb and level. Provide individually mounted pendant fixtures longer than 2 feet with twin stem hangers. Provide stem hanger with ball aligners and provisions for minimum 1" vertical adjustment. Mount continuous rows of fixtures with an additional stem hanger greater than number of fixtures in the row.
- K. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code.
- L. Support surface mounted fixtures greater than 2 feet in length at a point in addition to the outlet box fixture stud.

3.03 FIELD QUALITY CONTROL:

- A. Permanent LED fixtures installed as part of the Contract may not be used for construction lighting.
- B. At Date of Substantial Completion, replace lamps in interior lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Architect.
- C. Any lamp or LED Module as judged by the Architect as having a different apparent color or apparent color rendering shall be replaced by the Contractor without any additional cost.

3.04 AIMING, ADJUSTMENT, AND CLEANING

- A. All adjustable lighting units shall be aimed by the Contractor under the supervision of the Architect. All aiming shall be done after the installation is complete. Where daylight interferes, as deemed by the Architect, with the aiming the aiming shall be done at night.
- B. Clean interior lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses.
- C. Protect installed fixtures from damage during remainder of construction period.

3.05 DEMONSTRATION

- A. Upon completion of installation of interior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION

**SECTION 27 0000
COMMUNICATIONS**

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide and install a complete data and fiber wiring system. This system shall include but not limited to patch panels, punch down blocks and terminators, plenum rated wiring of category specified, cable jacks, plates, labels, AutoCAD drawings that include corresponding device outlet designations for each and every outlet, complete test meeting IEEE TIA 568b standards for each device/wire after completion of installation, etc. All wiring to be installed and supported independent of all other support systems in a neat and organized fashion. Wiring shall be routed so there is separation from all electrical devices, fixtures, electrical power wiring, etc.

1.02 STANDARDS

- A. Conformance to the latest revision of the following is required under this specification.
 - 1. FCC Part 15 - Radio Frequency Devices and Radiation Limits
 - 2. FCC Part 68 - Connection of Terminal Equipment to the Telephone Network
 - 3. NEC
 - 4. National, state, and local building and fire codes.
 - 5. TIA/EIA 568 - Commercial Building Telecommunications Cabling Standard
 - 6. TIA/EIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 7. TIA/EIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
 - 8. UL

1.03 GENERAL REQUIREMENTS

- A. The cable plant to support the data requirements will be wired in a star topology. Provide network attachment points (NAPS) at locations shown on the drawings.
- B. Provide new telecommunication backboards where shown on drawings. Provide on this backboard the appropriate number of termination/connection blocks, having the appropriate capacities, as required for all telephone cables being connected as part of this project, plus 25% "future" telephones cables, and make all required connections. Provide all required cross connections.
- C. Provide data patch panels to the building; make thereon all connections required for the data cables being provided as part of the project, utilizing connections hardware which is appropriate for the respective applications.
- D. Provide telephone outlets where shown on the drawings. Each telephone outlet shall consist of an outlet box recessed to the full extent practicable.
- E. Provide data outlets, including wireless access point, where shown on the drawings. Each computer and WAP outlet shall consist of an outlet box recessed to the full extent practicable.
- F. Provide a combination telephone/data outlet where shown on the drawings. Each combination shall consist of an outlet box recessed to the full extent practicable.
- G. Outlet boxes shall be a double gang box with a single gang reduction ring.
- H. Provide a 3/4" EMT conduit, from each telephone outlet and each data outlet (into the drop ceiling or to equipment room backboard, unless shown on the drawings otherwise. Provide a cable from each telephone station outlet and data outlet, though the respecting conduit to the appropriate telecommunication equipment room backboard or patch panel located in the building. Make the proper cable termination/connection at each end of the each such cable utilizing the connecting hardware which is appropriate for the respective applications.
- I. Completely test and prove all data cables, all telephone cables, all terminations/connections, all

equipment, and all devices, before and after installation and connection, to the architect's and the owner's complete satisfaction, and as required for the proper operation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products of one of the following or prior approved equal:
 - 1. Mohawk
 - 2. Berk-Tek
 - 3. Belden
 - 4. Leviton
 - 5. Ortronics
 - 6. Nordx
 - 7. Hubbell

2.02 HORIZONTAL DATA & TELEPHONE CABLE – IDF TO STATION & IDF TO CAMERAS

- A. Category 6, 100 ohm, 4-pair, unshielded twisted pair (UTP), #24 AWG insulated copper conductors
- B. Performance margin: 250 MHz
- C. Performance parameters

PARAMETER	MARGIN		
	100 MHz	200 MHz	250 MHz
Insertion Loss	1.1 dB	1.5 dB	1.8 dB
Return Loss	4.0 dB	4.0 dB	4.0 dB
PSNEXT	4.0 dB	4.0 dB	4.0 dB
PSACR-N	5.1 dB	5.5 dB	5.8 dB
PSACR-F	5.5 dB	5.5 dB	5.5 dB

- D. Primary transmission characteristics:
 - 1. Maximum DC resistance at 20C: 9.38 ohms/328 feet
 - 2. Maximum DC resistance unbalance: 5%
 - 3. Maximum mutual capacitance: 5.6nF/328 feet
 - 4. Maximum capacitance unbalance: 330 pF/328 feet
 - 5. Maximum propagation delay skew: 25 ns/328 feet
 - 6. NVP - plenum: 72% @ 10 MHz
- E. Type: CMP
- F. Jacket Color
 - 1. Telecom: Blue
 - 2. Camera: White
- G. Insulation: Fully insulated with retardant low-smoke thermoplastic material.
- H. Color code twisted pairs individually, within color coded bundles, to industry standards (ANSI/ICEA Publications 80-576, and EIA-230).

2.03 HORIZONTAL DATA & TELEPHONE CABLE – IDF TO WAP

- A. Category 6A, 4-pair, unshielded twisted pair (UTP), #23 AWG insulated copper conductors
- B. Performance margin: 500 MHz
- C. Primary transmission characteristics:

1. Maximum DC resistance at 20C: 9.38 ohms/328 feet
 2. Maximum DC resistance unbalance: 4%
 3. Maximum mutual capacitance: 5.6nF/328 feet
 4. Maximum capacitance unbalance: 330 pF/328 feet
 5. Maximum propagation delay skew: 25 ns/328 feet
 6. NVP - plenum: 67% @ 10 MHz
- D. Type: CMP
- E. Jacket Color: WAP: Yellow
- F. Insulation: Fully insulated with retardant low-smoke thermoplastic material.
- G. Color code twisted pairs individually, within color coded bundles, to industry standards (ANSI/ICEA Publications 80-576, and EIA-230).

2.04 HORIZONTAL CABLING PATCH PANELS

- A. Rack mounted, 48-port, modular panel
- B. Transmission characteristics: 250 MHz for all ports
- C. Spare capacity: 25%
- D. One-piece steel construction with factory-applied black baked enamel finish, with device, junction fittings and other matching accessories as required for a complete category 6 system and per UL 5.

2.05 FIBER SWITCH

- A. Owner furnished and installed.

2.06 LABELS

- A. Provide self-laminating adhesive labels, machine printable with a laser printer suitable for cable diameters installed.
- B. Printable area: 2-inches by 1/2-inch
- C. Color: white

2.07 CONNECTORS

- A. Fiber - Backbone cabling multimode fiber optic connectors types as determined by the data switch manufacturer.
- B. Color to be selected at time of submittal for each type.
- C. Copper
 1. Category 6, 8-pin modular connectors, T568-a wired.
 2. Incorporate crosstalk compensation and impedance matching circuitry.
 3. Transmission performance: Up to 300 MHz
- D. Provide station outlets with connectors. Provide permanent machine generated clear laminated labels on the front of each faceplate or surface box.

2.08 CABLE SUPPORTS

- A. Provide J-hooks rated to support category 6 cable and optical fiber cable, mounted 5-feet on-center for support of horizontal cabling. Provide J-hooks with a static load capacity of 30 pounds per hook and fastener hole that accepts 1/4-inch bolts Do not exceed 40 percent fill ratio.
- B. Galvanized steel construction and 90 degree rolled safety edges.
- C. Latched retainers to contain cables within the hook area.

2.09 EQUIPMENT RACKS

- A. Modular steel units designed for telecommunications terminal support and coordinated with

dimensions of units to be supported.

- B. Wall-mounting: aluminum, hinged wall bracket with provisions for power strip mounting.
- C. Floor-mounting: steel, freestanding, modular, with vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.
- D. EIA open frame relay racks
- E. 19" wide panel spaces by 84" overall height
- F. 60601-T6 Aluminum Alloy
- G. Provide horizontal cable organizer
- H. Provide vertical cable management sections with swing-away cable retainers

2.10 INNERDUCT AND ACCESSORIES:

- A. 1-1/2-inch nominal inner diameter
- B. Provide corrugated innerduct with a polyethylene pull rope (minimum pull tensions rating of 1,200 lb) pre-installed for the installation of cable.
- C. Provide each innerduct continuous and uniquely colored for identification.
- D. Velcro Cable Ties: 3/4-inch wide with a minimum 2 inch overlap.

2.11 FACEPLATES

- A. Face plates shall be single gang with multi-ports as required for terminations. See 26 27 26 – Wiring Devices for colors.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The data cable will be terminated on RJ45 TIA/EIA CAT 6 modular patch panels with a 110 termination that will be mounted in a 2 post rack to be bolt mounted to the floor by the contractor in designated area. All data cabling terminating in the rack will have a service loop of no less than 8 feet located above the ceiling where it enters the room. All data cabling will be installed IAW with TIA/EIA-568b "Commercial Building Standard for Telecommunications Pathways and Spaces". Telephone cabling will be installed per telephone industry standard TIA/EIA 568-b.2-1.
- B. Terminate all data and telephone drops. Modular wall plates and surface blocks shall be used to terminate the data cable and in the patch panels inside the rack. RJ45 TIA/EIA CAT 6 connectors shall be used for the data drops. All telephone cabling shall be terminated in RJ45 jacks and wall plates or surface blocks at outlets and on wall mounted punch down blocks.
- C. The telephone pair shall be terminated at the correct insert pair for a telephone application.
- D. Provide a continuous single cable, homogeneous in nature for every cable run. Splices are not permitted. Space as defined by the local building code. The cable shall be installed in a workmanlike manner and comply with standard TIA/EIA CAT 6 system requirements, and all local, state and national codes. Floor penetrations and conduit sleeves should allow 25% extra room for future cabling requirements.
- E. Support station cables exiting the telecommunications room every 5-feet on-center using j-hook cable hangers in call accessible ceilings.
- F. Do not exceed 300-feet in length from the termination at the user's faceplate to the termination at the telecommunications rooms.
- G. All wiring located above hard or inaccessible ceilings shall be routed in conduit. Where only a portion of the wiring is installed in hard or inaccessible ceilings the wiring shall be in conduit for the entire length of that is routed through the hard or inaccessible ceilings. Refer to Section 26 05 33 for conduit requirements.
- H. Provide a minimum of 6 inches of slack sheathed cable behind each station outlet faceplate. Coil slack cable inside the junction box or raceway as per the cabling manufacturer's installation standards.

- I. Route cables a minimum of 6 inches away or per TIA standards, which ever is greater, from power sources to reduce interference from EMI.
- J. Install cables with sufficient bending radius so as not to break or kink, shear or damage binders, or to interfere with transmission in any way.
- K. Neatly dress and organize cables in the accessible ceiling sequentially into groups of 12. Wrap every 24 inches with velcro cable ties as required. Do not tightly bundle cables together.
- L. Route cable homeruns, parallel and perpendicular to building structure allowing for bending radius, and along corridors for ease of access. Do not route cables through an adjacent space if a corridor borders at least one wall of the room.
- M. Provide permanent machine generated labels on each end of the cable no more than 4 inches from the edge of the cable jacket.
- N. Terminate cables with category 6 modular connectors and T568-a pin-pair assignment.
- O. Test cables to TIA/EIA 568 performance standard for the appropriate cable type. Reterminate or replace any cables that do not meet the performance standard.
- P. Floor mounted racks shall be securely attached to the concrete floor using a minimum 0.375" hardware.
- Q. Ground all telecommunication cable shields, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current-carrying conductor to the ground bar in the MDF/IDF using a minimum #6 AWG stranded copper bonding conductor and compression connector.

3.02 PROJECT CLOSE OUT

- A. Submit as-built drawings to contracting officer's representative prior to final acceptance of system:
 - 1. Scaled floor plans of telecommunication rooms showing exact placement of LAN racks and termination hardware.
 - 2. Scaled floor & overhead plans of telecommunication rooms showing exact placement of all overhead cable support routes.
 - 3. Installation details
 - 4. Provide data disks of each of the final as-built drawings prepared using Autocad software, fully representing actual installed conditions.

3.03 TESTING

- A. Test equipment shall meet the TIA-568-C requirements
- B. Test for defects in installation per TIA-568-C.
- C. Perform a basic continuity (pass/fail) and length test (295 feet).
- D. Test results
 - 1. Shall include the project name, date, cable type, conductor pair and cable ID, measurement direction, reference setup, and technicians name(s). The test equipment name, manufacturer, model number, serial number, software version, and last calibration date.
 - 2. Provide one electronic copy and one printed copy of cable test results documentation appropriately formatted for retrieval by the contracting officer.
 - 3. Provide the Architect and Owner with a written form of acceptance for signature. All corrections must be completed before acceptance is given.

END OF SECTION

SECTION 28 3111
FIRE ALARM SYSTEM – DIGITAL, ADDRESSABLE

PART 1 - GENERAL

1.01 SUMMARY

- A. This section covers fire alarm systems, including initiating devices, notification appliances, controls, wiring, conduit, and supervisory devices.
- B. The work of this section consists of providing labor, materials, tools, appliances and miscellaneous accessories associated with the fire alarm system as indicated on the drawings and specifications.
- C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions.
 - 1. Fire alarm system detection and notification operations.
 - 2. Control and monitoring of elevators, smoke control equipment, fire suppression systems, and other equipment as indicated in the drawings and specifications.
 - 3. One-way supervised automatic voice alarm operations.
- D. Related Sections include the following:
 - 1. Division 21 – Fire Protection
 - 2. Division 23 – HVAC Systems
 - 3. Section 260500 – Common Work Results for Electrical
 - 4. Section 260529 – Hangers & Supports for Electrical Systems
 - 5. Section 260533 – Raceways & Boxes for Electrical Systems
 - 6. Section 260553 – Identification for Electrical Systems

1.02 SYSTEM DESCRIPTION

- A. Provide a complete digital and addressable fire alarm system with voice evacuation. System shall operate as a fire alarm system for the building. The main fire command center shall be capable of assuming all audio command functions such as emergency paging, audio zone control, and separate alarm, supervisory and trouble signals from the remote node panel.

1.03 PERFORMANCE REQUIREMENTS

- A. Comply with all applicable standards below:
 - 1. NFPA 101
 - 2. NFPA 70
 - 3. NFPA 72
 - 4. NFPA 90A
 - 5. IBC
 - 6. IMC
 - 7. ADAAG
 - 8. Local AHJ
 - 9. UL: Each and every item of the Fire Alarm System shall be listed under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.
- B. General: Provide a complete, non-coded addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, monitoring and control devices as indicated on the drawings and as specified herein.
- C. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in

a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory. System shall be capable of storing dual configuration programs with one active and one in reserve. Panel shall be capable of full system operation during a new configuration download.

- D. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.
- E. Recording Of Events: Record all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout differentiates alarm signals from all other printed indications.
- F. Wiring/Signal Transmission:
 - 1. Transmission shall be hard-wired, using separate individual circuits for each zone of alarm operation as required or addressable signal transmission, dedicated to fire alarm service only.
 - 2. System connections for initiating device circuits shall be Class B, Style D, signaling line circuits shall be Class B, Style 4 and notification appliance circuits shall be Class B, Style Y.
 - 3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.
- G. Remote Access:
 - 1. FACP shall include the necessary hardware to provide remote access through a dial-up service modem.
 - 2. A personal computer or technician's laptop, configured with terminal emulation software shall have the ability to access the FACP for diagnostics, maintenance reporting and information gathering.
 - 3. FACP shall include the necessary hardware to provide remote access via an internet/intranet interface. The internet interface shall provide an alternative access to system information using the familiar interface of a standard internet browser.
 - 4. FACP shall include the necessary hardware to provide third party access through a serial interface connection and be agency listed for specific interfaces and for the purpose.
- H. Required Functions: The following are required system functions and operating features:
 - 1. Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
 - 2. Non-interfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent addressable device activations.
 - 3. Supervising Station: Automatically receive routed alarm, supervisory, and trouble signals from other future fire alarm panels on campus.
 - 4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator, indicating the type of device, the operational state of the device (i.e alarm, trouble or supervisory) and shall display the custom label associated with the device.
 - 5. General Alarm: A system general alarm shall include:
 - a. Indication of alarm condition at the FACP and the annunciator(s).

- b. Identification of the device/zone that is the source of the alarm at the FACP and the annunciator(s).
 - c. Operation of audible and visible notification appliances until silenced at FACP.
 - d. Closing doors normally held open by magnetic door holders.
 - e. Unlocking designated doors.
 - f. Shutting down supply and return fans serving zone where alarm is initiated.
 - g. Closing smoke dampers on system serving zone where alarm is initiated.
 - h. Initiation of smoke control sequence.
 - i. Transmission of signal to the supervising station.
 - j. Initiation of elevator Phase I functions (recall, shunt trip, illumination of indicator in cab, etc.) in accordance with ASME/ANSI A17.1, when specified detectors or sensors are activated, as appropriate.
6. Supervisory Operations: Upon activation of a supervisory device such as a tamper switch, the system shall operate as follows:
- a. Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.
 - b. Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
 - c. Record the event in the FACP historical log.
 - d. Transmission of supervisory signal to the supervising station.
 - e. Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.
7. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible and visible alarm signals shall cease operation.
8. System Reset
- a. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-arming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
 - b. Should an alarm condition continue, the system will remain in an alarmed state.
9. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.
10. Walktest: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:
- a. The city circuit connection and any suppression release circuits shall be bypassed for the testing group.
 - b. Control relay functions associated with one of the 8 testing groups shall be bypassed.
 - c. The control unit shall indicate a trouble condition.
 - d. The alarm activation of any initiating device in the testing group shall cause the audible notification appliances assigned only to that group to sound a code to identify the device or zone.
 - e. The unit shall automatically reset itself after signaling is complete.

- f. Any opening of an initiating device or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.
- I. Analog Smoke Sensors
 - 1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
 - 2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
 - 3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 5 selectable sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
 - 4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a CRT Display or printed for annual recording and logging of the calibration maintenance schedule.
 - 5. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported to the Supervising Station. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.
 - 6. The FACP shall continuously perform an automatic self-test on each sensor that will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
 - 7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.
 - 8. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.
 - 9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.
- J. Audible Alarm Notification: By voice evacuation and tone signals on loudspeakers in areas as indicated on drawings.
 - 1. Automatic Voice Evacuation Sequence:
 - a. The audio alarm signal shall consist of an alarm tone for a maximum of five seconds followed by an automatic digital voice message. At the end of the voice message, the alarm tone shall resume. This sequence shall sound continuously until the "Alarm Silence" switch is activated.
 - b. All audio operations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.
- K. Speaker: Speaker notification appliances shall be listed to UL 1480.

1. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire.
 2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
 3. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.
- L. Fire Suppression Monitoring
1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
 2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
 3. WSO: Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.
- M. Power Requirements
1. The control unit shall receive AC power via a dedicated fused disconnect circuit.
 2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
 3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.
 4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously at the user interface while incoming power is present.
 5. The system batteries shall be supervised so that a low battery or a depleted battery condition, or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.
 6. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control.
 7. The system shall support 110% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
 8. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

1.04 SUBMITTALS

- A. A minimum of 2 hard copies shall be delivered to the Architect. Review of any electronic submittal to the authority having jurisdiction will not begin until the hard copies are delivered to the Architect.
- B. Product Data
1. Sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification.
 2. Sheets showing UL compliance.
 3. Manufacturers published instructions.
- C. Shop Drawings
1. Name and location of protected premises, owner, and occupant
 2. Name of installer or contractor

3. Device legend and symbols in accordance with NFPA 170 or other symbols acceptable to AHJ.
4. Wiring diagrams from manufacturer.
5. Floor plans with point of compass and a graphic scale showing, at a minimum, the following
 - a. Floor plan of the project with room and area descriptions
 - b. All equipment and device locations
 - c. Wiring and circuitry between devices and equipment
 - d. Location of fire alarm primary power disconnect
 - e. Identification of any ceiling over 10 feet in height
6. System details including location of FACP, all devices, circuiting and details of graphic annunciator.
7. Riser diagram showing all major equipment, panels, power supplies, NACs, and devices
8. System power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate in accordance with the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
9. Control unit diagrams showing, at a minimum, the following:
 - a. Identification of control equipment
 - b. Location of control equipment
 - c. All field wiring terminals and terminal IDs
 - d. All circuits connected to field wiring terminals and circuit IDs
 - e. All indicators and manual controls
 - f. Field connections to supervising station equipment, releasing equipment, or emergency safety control interfaces
- D. Written narrative describing the system.
- E. System Operation: System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, SLC, NAC, relay, sensor, and auxiliary control circuits.
- F. Sequence of operation matrix.
- G. Qualification Data: Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
- H. Maintenance Data:
 1. Operating instructions for FACP
 2. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
- I. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions, if required, to make clarifications or revisions to obtain approval.
- J. Provide any other information required by NFPA 72.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Personnel shall be trained and certified by manufacturer for installation of equipment required in the Project.
 - 2. Personnel certified by NICET as Fire Alarm Level I
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 by a testing agency acceptable to the authorities having jurisdiction, and marked for intended use.
- C. All control panels shall be by the same manufacturer.
- D. All initiating devices and annunciation devices shall be by the same manufacturer.

1.06 MAINTENANCE SERVICE

- A. Maintenance Service Contract: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives.
- B. Basic Services: Systematic, routine maintenance visits on a quarterly basis at times scheduled with the Owner. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.
- C. Additional Services: Perform services within the above 12-month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.
- D. Renewal of Maintenance Service Contract: No later than 60 days prior to the expiration of the maintenance services contract, deliver to the Owner a proposal to provide contract maintenance and repair services for an additional one-year term. Owner will be under no obligation to accept maintenance service contract renewal proposal.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. Notifier
 - 2. Mircom
 - 3. Siemens
 - 4. Honeywell
 - 5. Johnson Control
 - 6. System Sensor
 - 7. Wheelock

2.02 FIRE ALARM CONTROL PANEL (FACP)

- A. General: Comply with UL 864, "Control Units and Accessories for Fire Alarm Systems".
- B. The following FACP hardware shall be provided:
 - 1. Power limited base panel with red cabinet and door, 120 VAC input power.
 - 2. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FACP LCD display.
 - 3. Municipal city circuit connection with disconnect switch, 24VDC remote station (reverse polarity), local energy, shunt master box, or a form "C" contact output.
 - 4. One auxiliary electronically resettable fused 2A @24VDC output, with programmable disconnect operation for 4-wire detector reset.
 - 5. One auxiliary relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
 - 6. Where required provide intelligent remote battery charger for charging up to 110Ah batteries.

7. Power Supplies with integral intelligent notification appliance circuit Class B for system expansion.
 8. (4) form "C" Auxiliary Relay Circuits (Form C contacts rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory of other fire response functions. Relays shall be capable of switching up to ½ A @ 120VAC, inductive.
 9. The FACP shall support (6) RS-232-C ports and one service port.
 10. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
 11. Programmable DACT for either common event reporting or per point reporting.
 12. Service port modem for dial in passcode access to all fire control panel information.
 13. Local area network card with a firmware package that utilized peer-to-peer, inherently regenerative communication format and protocol.
- C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.
- D. Alphanumeric Display and System Controls: Panel shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.
- E. Voice Alarm: Provide an emergency communication system, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:
1. Amplifiers comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Amplifiers shall provide an onboard local mode temporal coded horn tone as a default backup tone. Test switches on the amplifier shall be provided to test and observe amplifier backup switchover. Each amplifier shall communicate to the host panel amplifier and NAC circuit voltage and current levels for display on the user interface. Each amplifier shall be capable of performing constant supervision for non-alarm audio functions such as background music and general paging.
 2. All announcements are made over dedicated, supervised communication lines. All risers shall support Class B wiring for each audio channel.
 3. Emergency voice communication audio controller module shall provide up to 32 minutes of message memory for digitally stored messages. Provide supervised connections for master microphone and up to 5 remote microphones.
 4. Status annunciator indicating the status of the various voice alarm speaker zones and the status of fire fighter telephone two-way communication zones.
- F. Distributed Module Operation: FACP shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Style 4 (Class B) supervised serial communications channel (SLC):
1. Amplifiers, voice and telephone control circuits
 2. Addressable Signaling Line Circuits
 3. Initiating Device Circuits
 4. Notification Appliance Circuits
 5. Auxiliary Control Circuits
 6. Graphic Annunciator LED/Switch Control Modules: In systems with two or more Annunciators and/or Command Centers, each Annunciator/Command Center shall be programmable to allow multiple Annunciators/Command Centers to have equal operation priority or to allow hierarchal priority control to be assigned to individual Annunciator/Command Center locations).

2.03 REMOTE LCD ANNUNCIATOR

- A. Provide a remote LCD Annunciator, where shown on plans, with the same "look and feel" as the FACP operator interface. The Remote LCD Annunciator shall use the same Primary Acknowledge, Silence, and Reset Keys; Status LEDs and LCD Display as the FACP.
- B. Annunciator shall have super-twist LCD display with two lines of 40 characters each. Annunciator shall be provided with four (4) programmable control switches and associated LEDs.
- C. Under normal conditions the LCD shall display a "SYSTEM IS NORMAL" message and the current time and date.
- D. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
- E. The LCD shall display the following information relative to the abnormal condition of a point in the system:
 - 1. 40 character custom location label.
 - 2. Type of device (e.g., smoke, pull station, waterflow).
 - 3. Point status (e.g., alarm, trouble).
- F. Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable in the disabled position. Acknowledge, Silence and Reset operation shall be the same as the FACP.

2.04 EMERGENCY POWER SUPPLY

- A. Components include battery, charger, and an automatic transfer switch.
- B. Battery: Sealed lead-acid type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm notification devices in alarm mode for a period of 15 minutes.
- C. Units shall be sized to handle an additional 10% of connected load for future devices.

2.05 ADDRESSABLE MANUAL PULL STATIONS

- A. Description: Addressable single- or double-action type, red, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.
- B. Protective Shield: Where required, as indicated on the drawings, provide a tamperproof, clear shield and red frame that easily fits over manual pull stations. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

2.06 SMOKE SENSORS

- A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
 - 1. Factory Nameplate: Serial number and type identification.
 - 2. Operating Voltage: 24 VDC, nominal.
 - 3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
 - 4. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.

5. Quick Connect Arrangement: Photoelectric sensor and electronics in a single piece construction which shall twist-lock onto a mounting base that attaches to a standard electrical box.
 6. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
 7. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
 8. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
 9. The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI.
 10. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.
 11. Removal of the sensor head for cleaning shall not require the setting of addresses.
- B. Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type.
- C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.
- D. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.
1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACP.
 2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
 3. Duct Housing shall provide a relay control trouble indicator Yellow LED.
 4. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
 5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
 6. Duct Housing shall provide a magnetic test area and Red sensor status LED.
 7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
 8. Each duct smoke sensor shall have a Remote Test Station with an alarm LED and test switch.
 9. Where indicated provide a NEMA 4X weatherproof duct housing enclosure that shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.
- E. Projected Beam Detectors
1. UL listed to Standard 268 and consist of a separate transmitter and receiver capable of being powered separately or together.

2. Capable of operating in short range (30' to 100') or long range mode (100' to 330').
3. LEDs on the receiver and the transmitter that ensure proper alignment of the unit.
4. Automatic gain control which compensates for gradual signal deterioration.

2.07 HEAT SENSORS

- A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.
- B. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.
- C. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and] programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.
- D. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

2.08 ADDRESSABLE CIRCUIT INTERFACE MODULES

- A. Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of AHU systems.
- B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.
- C. There shall be the following types of modules:
 1. Type 1: Monitor Circuit Interface Module:
 - a. For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACP.
 - b. For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.
 2. Type 2: Line Powered Monitor Circuit Interface Module
 - a. This type of module is an individually addressable module that has both its power and its communications supplied by the two wire signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.
 - b. This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.
 3. Type 3: Single Address Multi-Point Interface Modules
 - a. This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions (normal, open, current limited, and

- short). The input circuits and output relay operation shall be controlled independently and disabled separately.
- b. This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.
- c. This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The two-wire signaling line circuit shall supply power and communications to the module.
- 4. Type 4: Line Powered Control Circuit Interface Module
 - a. This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.
- 5. Type 5: 4-20 mA Analog Monitor Circuit Interface Module
 - a. This module shall communicate the status of a compatible 4-20 mA sensor to the FACP. The FACP shall annunciate up to three threshold levels, each with custom action message; display and archive actual sensor analog levels; and permit sensor calibration date recording.
- D. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.09 ALARM NOTIFICATION APPLIANCES

- A. Notification Appliances: The Contractor shall furnish and install notification appliances and accessories to operate on compatible signaling line circuits (SLC).
 - 1. Notification appliance operation shall provide power, supervision and separate control of horns and strobes over a single pair of wires. The controlling channel (SLC) digitally communicates with each appliance and receives a response to verify the appliance's presence on the channel. The channel provides a digital command to control appliance operation. SLC channel wiring shall be unshielded twisted pair (UTP), with a capacitance rating of less than 60pf/ft and a minimum 3 twists (turns) per foot.
 - 2. Class B (Style 4) notification appliances shall be wired without requiring traditional in/out wiring methods; addressable "T" tapping shall be permitted. Up to 63 appliances can be supported on a single channel.
 - 3. Each notification appliance shall contain an electronic module and a selectable address setting to allow it to occupy a unique location on the channel. This on-board module shall also allow the channel to perform appliance diagnostics that assist with installation and subsequent test operations. A visible LED on each appliance shall provide verification of communications and shall flash with the appliances address setting when locally requested using a magnetic test tool.
- B. Addressable Controller: Shall supervise channel (SLC) wiring, communicate with and control addressable notification appliances. It shall be possible to program the high/lo setting of the audible appliances by channel from the addressable controller.
- C. Visible Only: Addressable strobe shall be listed to UL 1971. The unit shall consist of a xenon flash tube and associated lens/reflector system. The unit enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special

adapters or trim rings. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The appliances shall be provided with different minimum flash intensities of 15cd, 30cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific appliance.

- D. Speaker/Visible: Combination speaker/visible units combine the speaker and visible functions into a common housing. The unit shall be listed to UL 1971 and UL 1480. The speaker operates on a 25VRMS or 70.7VRMS NAC.
 - 1. Twisted/shielded wire is required for speaker connections on a standard 25VRMS or 70.7VRMS NAC and UTP conductors, having a minimum of 3 twists per foot is required for addressable strobe connections.
 - 2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
 - 3. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for general signaling.
 - 4. The S/V installs directly to a 4" square, 1 ½" deep electrical box with 1 ½" extension.
- E. Isolator Module: Isolator module provides short circuit isolation for addressable notification appliance SLC wiring. Isolator shall be listed to UL 864. The Isolator shall mount directly to a minimum 2 1/8" deep, standard 4" square electrical box, without the use of special adapter or trim rings. Power and communications shall be supplied by the Addressable Controller channel SLC; dual port design shall accept communications and power from either port and shall automatically isolate one port from the other when a short circuit occurs. The following functionality shall be included in the Isolator module:
 - 1. Report faults to the host FACP.
 - 2. On-board yellow LED provides module status.
 - 3. After the wiring fault is repaired, the Isolator modules shall test the lines and automatically restore the connection.

2.10 ADDRESSABLE APPLIANCES NAC POWER EXTENDER

- A. The addressable controller shall be a stand-alone panel capable of powering a minimum of 3 signaling line circuits. Each channel shall be rated for 2.5 amps and support up to a minimum of 63 addressable notification appliances. Power and communication for the notification appliances shall be provided on the same pair of wires.
- B. Addressable SLC notification appliance circuits shall be Class B, Style 4.
- C. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.
- D. The NAC extender panel may be mounted close to the host control panel or can be remotely located.
- E. Provide built-in synchronization for notification appliances on each circuit without the need for additional synchronization modules.
- F. Each unit shall be capable of supporting both synchronized and non-synchronized notification devices at the same time.

2.11 WIRE, CABLE, AND CONDUIT

- A. Wire and cable shall be UL listed and labeled as complying with NFPA 70.
- B. Signaling Line Circuits and Initiating Device Circuits:
 - 1. Twisted, shielded pair, not less than #18 AWG
 - 2. NFPA 70 Classification CI, for power-limited fire alarm signal service.
 - 3. UL listed as Type FPLP
 - 4. UL listed as Type FPLR for riser applications
- C. Notification Appliance Circuits: Not less than #14 AWG

- D. Non-Power-Limited Circuits: Solid-copper conductors with 600 volt rated, 75 deg C, color coded insulation.
- E. All cabling shall meet the circuit and pathway requirements of NFPA 72-2010.
- F. See Section 260533 for conduit requirements

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

- A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.
- B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
 - 1. Factory trained and certified personnel
 - 2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
 - 3. Personnel licensed or certified by state or local authority.

3.02 EQUIPMENT INSTALLATION

- A. Furnish and install a complete fire alarm system as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.
- B. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.
- C. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.
- D. Install manual station with operating handle 48 inches (1.22 m) above floor. Install wall mounted audible and visual notification appliances not less than 80 inches (2.03 m) above floor to bottom of lens and not greater than 96 inches (2.44 m) above floor to bottom of lens.
- E. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
- F. Make conduit and wiring connections to sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, duct smoke detectors.
- G. Automatic Detector Installation: Conform to NFPA 72.
- H. Provide labels and identification per NEC requirements and 26 05 53.

3.03 WIRING & CONDUIT INSTALLATION

- A. Conduit serving the fire alarm system shall be dedicated to the fire alarm system.
- B. Devices shall be wired such that no more than 50 addressable devices are lost at any single point of failure in a signaling line circuit.
- C. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the control panel manufacturer.
- D. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code.
- E. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

- F. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.
- G. Mount end-of-line device in box with last device or separate box adjacent to last device for Class "B" supervision.
- H. Provide labels and identification per NEC requirements and 26 05 53.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
- B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
 - 1. Factory trained and certified.
 - 2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
 - 3. International Municipal Signal Association (IMSA) fire alarm certified.
 - 4. Certified by a state or local authority.
 - 5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
- C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning
- D. Inspection:
 - 1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
 - 2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- E. Acceptance Operational Tests:
 - 1. Perform operational system tests to verify conformance with specifications:
 - a. Each alarm initiating device installed shall be operationally tested. Each device shall be tested for alarm and trouble conditions. Contractor shall submit a written certification that the Fire Alarm System installation is complete including all punch-list items. Test battery operated emergency power supply. Test emergency power supply to minimum durations specified. Test Supervising Station Signal Transmitter. Coordinate testing with Supervising Station monitoring firm/entity.
 - b. Test each Notification Appliance installed for proper operation. Submit written report indicating sound pressure levels at specified distances.
 - c. Test Fire Alarm Control Panel and Remote Annunciator.
 - 2. Provide minimum 10 days notice of acceptance test performance schedule to Owner, and local Authority Having Jurisdiction.
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Use NFPA 72 Forms for documentation.
- H. Final Test, Record of Completion, and Certificate of Occupancy:

1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy. Provide completed NFPA 72 Record of Completion form to Owner and AHJ.

3.05 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.
- B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound pressure levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.06 DEMONSTRATION

- A. Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and operating equipment. Provide at least 8 hours of training.

END OF SECTION

SECTION 31 1000 - 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.
- B. Documents:
 - 1. Soil borings, site preparation, and pavement recommendations – herein specified as the Geotechnical Report. Copies of report available from Architect's office upon request.

1.2 SUMMARY

- A. Section Includes:
 - 1. Removing existing vegetation.
 - 2. Clearing and grubbing.
 - 3. Stripping and stockpiling topsoil.
 - 4. Removing above- and below-grade site improvements.
 - 5. Disconnecting, capping or sealing, and removing site utilities.
 - 6. Temporary erosion and sedimentation control.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

- A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "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; 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 larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

- A. Except for 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 video recordings.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 FIELD 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 trafficways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify Louisiana One Call for area where Project is located at least forty-eight (48) hours prior to beginning site clearing operations.
- C. Do not commence site clearing operations until temporary erosion- and sedimentation-control and tree-protection measures are in place.
- D. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 2010 "Earth Moving (Site)".
 - 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. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in this section.
- 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. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 EXISTING UTILITIES

- A. 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.
- B. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- C. 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 two (2) days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

3.4 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 larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 - 3. Use only hand methods or air spade 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.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth indicated on Drawings 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 larger 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 or other materials. 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.

3.6 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.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Surplus soil material and unsuitable topsoil shall be stockpiled within the property boundary and outside of the limits of construction. Stockpile location shall be determined in the field with the project owner.

END OF SECTION 31 1000

SECTION 31 2010 - EARTH MOVING (SITE)

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.
- B. Documents:
 - 1. Soil borings, site preparation, and pavement recommendations – herein specified as the Geotechnical Report. Copies of report available from Architect's office upon request.
- C. All references to LADOTD specifications are to the Louisiana Standard Specifications for Roads and Bridges, 2016 Edition.
- D. Refer to section 31 2000 "Earth Moving – Building Pad" for earth moving requirements beneath proposed building.

1.2 SUMMARY

- A. Section Includes:
 - 1. Excavating and filling for rough grading the Site outside of the building pad.
 - 2. Preparing subgrades for walks, pavements, turf and grasses.
 - 3. Structural fill for concrete pavements.
 - 4. Bedding course for utility trenches.
 - 5. Geotextile fabrics.
 - 6. Detectable warning tape.
 - 7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.3 DEFINITIONS

- A. Backfill: Soil 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. Bedding Course: Granular layer placed over the excavated subgrade in a trench before laying pipe.
- C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- E. 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 Engineer. Authorized additional excavation

and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

- F. Fill: Soil materials used to raise existing grades.
- G. Select of Structural Fill: Fill material meeting the criteria established in subsequent sections, and that is suitable for placement beneath areas of proposed pavement.
- 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. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below base, drainage fill, drainage course, or topsoil materials.
- J. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 SUBMITTALS

- A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 1. Classification according to ASTM D2487.
 2. Laboratory compaction curve according to ASTM D698.
- B. Laboratory gradation reports for specified base course and bedding course.

1.5 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.6 FIELD CONDITIONS

- A. Utility Locator Service: Notify Louisiana One Call (811) for area where Project is located before beginning earth-moving operations.
- B. Do not commence earth-moving operations until plant-protection measures specified in Section 31 1000 "Site Clearing" are in place.

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 for Select or Structural Fill: Soil Classification CL in accordance with the United Soil Classification System (USCS); inert (non-expansive); free of rock or gravel, debris, waste, frozen materials, vegetation, and other deleterious matter, and with maximum particle size of less than 2 inches. This material shall conform to the following criteria:
 - 1. Liquid Limit: 45 maximum.
 - 2. Plasticity Index: 10 minimum, 25 maximum.
 - 3. Percent Retained on U.S. sieve #200: 25 maximum.
- C. Satisfactory Soils for Select or Structural Fill (Alternate): Soil Classification SP-SM, SM, SC; inert (non-expansive); free of rock or gravel, debris, waste, frozen materials, vegetation, and other deleterious matter. This material shall conform to the following criteria:
 - 1. Percent Passing U.S. sieve #200: 10 maximum.
 - 2. Percent Organic Content: 5 maximum.
- D. Satisfactory Soils for Non-Structural Fill: Soils used for fill outside of areas of proposed pavement or other structures shall be free of rock or gravel, debris, waste, frozen materials, and other deleterious matter. This material shall conform to the following criteria:
 - 1. Liquid Limit: 55 maximum.
 - 2. Plasticity Index: 10 minimum, 40 maximum.
 - 3. Percent Passing U.S. sieve #200: 12 minimum.
- E. Base Course: Material required beneath areas of pavement shall be granular, free-draining, and compacted over the prepared subbase or subgrade.
 - 1. Crushed stone or recycled crushed concrete pavement in accordance with LADOTD Standard Specification Sections 302 and 1003.03.1 or 1003.03.2.
- F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand in accordance with LADOTD Standard Specification Section 1003.10.2.

2.2 GEOTEXTILES

- A. Provide non-woven Class 'B' or 'C' (modified) in conformance with LADOTD specification section 1019 and all referenced sections.

2.3 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. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- C. 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.
 - 2. Provide temporary pumping systems to dewater all excavations that become inundated. Dewater within 24 hours of inundation.
 - 3. Install a dewatering system to keep subgrades dry and to convey ground water away from excavations. Maintain until dewatering is no longer required.
- D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Do not discharge sediment-laden water into existing public or private drainage systems.
- E. Remediation of compromised soils resulting from failure to comply with temporary drainage measures shall be performed with no changes in the Contract Sum or the Contract Time.
 - 1. Methods of remediation will be determined by the Geotechnical Engineer.

3.3 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.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, 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.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- 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 higher than top of pipe or conduit unless otherwise indicated.
 1. Clearance: 18 inches on each side of pipe or conduit.
- C. Trench Bottoms: Excavate trenches 6 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
- D. Excavations greater than 4 feet in depth shall require temporary shoring, bracing, or sheeting in lieu of unsupported trench sides.

3.6 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 all pavement subgrades with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 20 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Proof-roll under areas of proposed walks is not required.
 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in opposite 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 remediate as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 1. Deficient areas as outlined in this section shall be recorded on a project site plan by the Geotechnical Engineer, with the location and dimensions of the deficient areas indicated. This map shall be provided to the Architect before a change in Work will be considered.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Engineer, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation as directed by the Engineer.

3.8 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.

3.9 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. 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.
- C. Initial Backfill: 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.
- D. Final Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.10 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 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 of satisfactory soil material is not required.
 - 2. Under walks and pavements, use satisfactory soil material.
- C. Place select fill on subgrades free of mud, frost, snow, or ice.

3.11 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.

3.12 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. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
 - 1. Under pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95% percent.
 - 2. Under pavements, compact base course material at 100 percent.
 - 3. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 - 4. 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.
 - 5. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.13 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.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1½ inch.
 - 2. Walks: Plus or minus 1/2 inch.
 - 3. Pavements: Plus or minus 1/4 inch.

3.14 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and the following inspections:
 - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 - 2. Determine that fill material classification and maximum lift thickness comply with requirements.
 - 3. Determine, during placement and compaction, and at the required frequency, that in-place density of compacted fill complies with requirements.
 - 4. Establish optimum moisture content and stabilization ratios for the sub-base, if required.
 - 5. Recommend remedial measures for areas of unsuitable or unstable soils beneath proposed pavements.
- B. 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.

- C. Testing agency will determine classification of soils to be used for select of structural fill in accordance with United Soil Classification System (ASTM D2487). Atterberg Limits for the same samples shall be determined according to ASTM D4318.
- D. Testing agency will determine moisture content of fill material in accordance with ASTM D2216.
- E. Testing agency will test compaction of soils in place according to ASTM D1557, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 5000 sq. ft. or less of paved area, but in no case fewer than four tests per layer for each lift.
 - 2. 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 three 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.
- G. Testing agency will provide all test results to Engineer within forty-eight (48) hours of conducting each respective testing procedure.

3.15 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 Engineer; 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.

3.16 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.
 - 1. Surplus soil material shall not be deposited in Special Flood Hazard areas.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.
 - 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 2010

SECTION 31 21 00
EARTH MOVING (BUILDING PAD)

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
- B. Geotechnical Investigation by Terracon dated September 17, 2025. Geotechnical report may be obtained from Architect's office.
- C. **GC shall be responsible for installation of surcharge program per geotechnical report prior to construction on the site. Foundation design is based on the installation of the surcharge program per the geotechnical recommendations.**

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for buildings.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage course for slabs-on-grade.
 - 4. Excavating and backfilling for utility trenches.
 - 5. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.
- B. Related Sections include the following:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 31 Section "Concrete Drilled Piers and Shafts" for excavation of shafts and disposal of surplus excavated material.
 - 3. Division 03 Section "Cast-in-Place Concrete".

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. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

- C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Drainage Course: Course beneath the slab that minimizes upward capillary flow of pore water.
- E. 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. 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.
- F. Fill: Soil materials used to raise existing grades.
- G. 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.
- H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- I. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
 - 2. Test reports on borrow material.
 - 3. Field density test reports.
 - 4. One optimum moisture-maximum density curve for each type of soil encountered.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Perform work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

- C. Testing & Inspection Service: Owner will engage and pay for soil testing and inspection service for quality control testing during earthwork operations. Contractor shall pay for all retesting of failed tests.

1.6 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. Existing Utilities: Locate existing underground utilities before performing earthwork. If utilities are to remain in place, provide protection from damage during earthwork operations.
- C. Interruption of Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soils:
 - 1. Imported soil fill material used to raise the site grade shall be either a low plasticity silty or sandy clay (USCS Classification, CL) or a clayey sand (SC), shall be free of roots, construction debris, organic matter or any other deleterious materials, have a maximum clay lump size less than two (2) inches and have a liquid limit of less than 45 and a plasticity index value between 10 and 25. If a fine-grained sandy clay soil is used for select fill, close moisture content control will be required to achieve the recommended degree of compaction.
- B. Unsatisfactory Soils: Soils other than satisfactory soils.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 0 to +3 percentage points of the optimum moisture content at time of compaction as determined by the Standard Proctor test (ASTM D 698).

- C. 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.
- D. Drainage Course: Provide a stone or sand drainage layer (per list below) at contractor's option beneath the concrete slab and vapor retarder.
 - 1. A 4" thick layer number 8 washed gravel per ASTM C33, complying with the following gradation:

E.	Sieve Size	Percent Passing
F.	1/2"	100
G.	3/8"	85 to 100
H.	No. 4	10 to 30
I.	No. 8	0 to 10
J.	No. 16	0 to 5
 - 1. A 4" thick layer of number 57 crushed and washed limestone per ASTM C33. complying with the following gradation:

K.	Sieve Size	Percent Passing
L.	1-1/2"	100
M.	1"	95 to 100
N.	1/2"	25 to 60
O.	No. 4	0 to 10
P.	No. 8	0 to 5
 - 1. A 6" thick layer of clean, free draining sand free of roots, construction debris, organic matter or any other deleterious materials in accordance with ASTM C33. Sand fill shall have a maximum plasticity index of 7 in accordance with ASTM D 4318 and not more than 15% passing a No. 200 sieve, in accordance with ASTM C 117.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; 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.
- B. 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 earthwork operations.
- B. In order to prepare the building and pavement areas for fill or for insitu soils to be used as a final subgrade, the site shall be stripped of all vegetation, soft or loose surface soils, obstructions and all deleterious materials. This includes any loose or water-softened surface materials.
 1. When trees are removed, the entire root ball shall be excavated such that the remaining roots measure 1/2 inch in diameter, or less.
 2. Strip 6 inches of topsoil minimum at building pad, within 10 feet of the building limits and 5 feet beyond the toe of structural fills. Additional stripping may be required in some areas. The actual removal depth shall be determined in the field by the Testing Agency.
- C. Additional information for preparation requirements of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface, and treatment or improvement are specified in Division 31 Section "Site Clearing."
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

- E. If unstable subgrade is encountered after initial topsoil stripping, the Architect or Testing Agency may require the grading contractor to perform processing and drying of the upper 12 to 18 inches of native subgrade by frequent windrowing with a dozer or plowing with a set of heavy duty disc harrows for at least three consecutive working days to achieve stable conditions for fill placement before consideration other mitigation approaches. The windrowing and drying effort shall be performed during a period with at least three consecutive days forecasted to be dry. The processed areas shall be sealed with the dozer at the end of the day in case of unanticipated overnight rain. The subgrade drying effort described above shall be included in the base bid.
- F. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated materials as directed by Architect.
- G. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction (including all OSHA requirements). Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
- H. See Section 3.7 below for required proofroll of existing subgrade to be performed immediately after preparation work noted above is complete.

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.
 - 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

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.
- B. Avoid opening excavations during inclement weather.

- C. Excavations shall not have deleterious effects on adjacent foundations or structures. Sequence construction as required to avoid deep excavations adjacent to foundations or structures, or when deep excavations adjacent to foundations or structures are unavoidable, provide temporary shoring as required in consultation with Geotechnical Engineer.

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. 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.
 - 2. 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. Do not disturb bottom of excavations intended as bearing surfaces.
 - 3. The base of all excavations for structures shall be free of water, loose soil, unsuitable bearing materials including soft soil, and other foreign materials.

3.6 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 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 8 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 8 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill. Alternatively, excavate the trench 6" deeper than the bottom of the pipe and provide 6" bedding course.

3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.7 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll existing subgrade (after preparation as noted above has been completed) below the building slabs with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Contact Architect, Engineer, and Testing Agency 48 hours prior to proof-rolling. A representative of the Testing Agency must be on site during proof-rolling operations.
 2. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 3. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 4. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Testing Agency and as directed by Architect, and replace with compacted backfill or fill as directed.
 - a. Prior to consideration of removal and replacement of existing soils, drying and processing of existing subgrade for three consecutive dry days shall be performed as described in Section 3.1 and existing subgrade shall be retested by proof-roll immediately after drying and processing period is complete.
- 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 Architect, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2000 psi, may be used when approved by Architect.
 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

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.

3.11 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. 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.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with a lean concrete fill to elevation of bottom of footings. Provide a lean concrete fill with a 28-day compressive strength of 2500 psi.
- D. 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.
- E. 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 utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- G. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- H. All utility trenches that penetrate the building shall be effectively sealed to restrict water intrusion and flow through trenches that could migrate below the building. An effective clay "trench plug" that extends at least five (5) feet out from the face of the building exterior shall be constructed at each utility trench which penetrates the building perimeter. The plug material shall be a clay satisfactory soil compacted at a water content at or above the soils optimum water content. The clay satisfactory soil shall be placed to completely surround the utility line and be compacted.
- 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 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 1. Under steps and ramps, use satisfactory soil material.
 2. Under building slabs (and within 10 feet of building slab edges), use satisfactory soil material.
 3. Under footings and foundations, use satisfactory soil material
- 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 0 to +3 percentage points of the optimum moisture content at time of compaction as determined by the Standard Proctor test (ASTM D 698).
 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 the optimum moisture content allowance stated above and is too wet to compact to the specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials only after the site has been proof-rolled.

- B. 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.
- C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- D. Compact all satisfactory soil materials to at least 95 percent of the maximum dry density as determined by the Standard Proctor compaction test (ASTM D 698).

3.15 GRADING

- A. Site Grading: Slope grades to direct water away from buildings and to prevent ponding.

3.16 FIELD QUALITY CONTROL

- A. Special Inspections: Owner 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: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- C. Provide inspections and test in accordance with Chapter 17 of the International Building Code.
- D. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- E. Testing agency will test compaction of soils in place according to ASTM D 1557, ASTM D 2167, ASTM D 2922, ASTM D 2937 and ASTM D 698, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of building slab area, but in no case fewer than 3 tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 100 feet or less of trench length, but no fewer than 2 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 to depth required; recompact and retest until specified compaction is obtained.

- G. Testing agency shall verify materials below shallow foundations are adequate to achieve the design bearing capacity.

3.17 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 (or Engineer); reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off of Owner's property.

END OF SECTION 31 21 00

SECTION 31 3117 TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Chemical soil treatment.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Vapor barrier placement under concrete slab-on-grade.

1.03 REFERENCE STANDARDS

- A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Submittal Procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- C. Test Reports: Indicate regulatory agency approval reports when required.
- D. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.
- E. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.
- F. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing this type of work and:
 - 1. Having minimum of three (3) years documented experience.
 - 2. Approved by manufacturer of treatment materials.
 - 3. Licensed in the State in which the Project is located.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year installer's warranty against damage to building caused by termites.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

- A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.
- B. Manufacturers:
 - 1. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management.
 - 2. FMC Professional Solutions: www.fmcprosolutions.com.
 - 3. Syngenta Professional Products: www.syngentaprofessionalproducts.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- C. Toxicant Chemical: EPA (\\rs#1}) approved; synthetically color dyed to permit visual identification of treated soil.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

4024101 / Hahnville Branch Library	31 3117 - 1	Termite Control

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
- B. Spray apply toxicant in accordance with manufacturer's instructions.
- C. Apply toxicant at following locations:
 - 1. Under Slabs-on-Grade.
 - 2. At Both Sides of Foundation Surface.
- D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.
- E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.
- F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- G. Re-treat disturbed treated soil with same toxicant as original treatment.
- H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

- A. Do not permit soil grading over treated work.

SECTION 31 6219

TIMBER PILES

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.
- B. Geotechnical Investigation by Terracon dated September 17, 2025. Project # ET245148.R2

1.2 SUMMARY

- A. Section includes round timber piles.

1.3 UNIT PRICES AND PAYMENT

- A. The Contract Sum: Base the Contract Sum on number and dimensions of piles indicated on plans, plus not less than 12 inches of overlength.
 - 1. Include cost of probe piles indicated on plans in the base bid. Drive probe piles to refusal according to refusal criteria provided herein.
 - 2. Include the cost of the static test pile program as described under the STATIC TEST PILE section of this specification and as shown on the structural plans.
- B. No payment will be made for rejected piles, including piles driven out of tolerance, defective and/or imperfect piles, or piles damaged during handling or driving.

1.4 CONTRACTOR DUTIES

- A. Notification: The Contractor shall notify the Architect and the Testing Agency 48 hours prior to commencement of driving exploratory piles and project piles. Driving of any piles must not commence without representatives of the Testing Agency being present. The Contractor shall also notify the Director of the responsible regulatory agency at the least 24 hours in advance of pile driving.
- B. Provide an "As-Built" survey of pile locations as defined in the SUBMITTALS sections of this specification.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Testing and inspection services shall be conducted by the independent Testing Agency selected and paid for by the Owner. The Testing Agency employed by the Owner shall perform testing services required by Owner for pile foundations including:
 - 1. Perform inspections of all piles and mark conforming piles for identification. Inspection shall be performed at pile production facility.
 - 2. Logging of all driven piles as described under the SUBMITTALS section of this specification.
 - 3. Conducting a pile load test program as defined under the STATIC TEST PILE section of this specification and in conformance with the applicable requirements of the following standards and regulatory agencies.
 - a. American Society for Testing and Materials (ASTM).
 - b. International Building Code, 2012 Edition.
 - 4. Observation of pile-driving operations.
 - a. All piles not driven to the required driving criteria shall be reported to the Architect immediately.
 - 5. Vibration Monitoring.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: Show fabrication and installation details for piles.
 - 1. Including details of driving shoes, tips or boots, and pile butt protection when driving through rock or hard driving conditions requiring protection of the pile ends.
- C. Round timber pile treatment data.
- D. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion for approval prior to mobilizing pile driving rig to site.
- E. Static Pile Test Program:
 - 1. Submitting static pile test loading scheme to the Structural Engineer and Project Architect for review prior to commencing pile load test.
 - 2. Submit details of testing apparatus as defined under Part 3 in the STATIC TEST PILE section of this specification. These details shall be reviewed by the Structural Engineer and the Project Architect prior to commencing the pile load test.
 - 3. The testing agency shall record and provide to the Architect and General Contractor sufficient documentation of pile load test, such as graphs of loading versus pile movement, to fully explain how the pile reacted to applied loading. Submit report within three days of completing each test
- F. Pile-driving records. Submit copies of driving record of each pile to Architect and General Contractor not later than 2 days after driving. Include project name and number, name of Contractor, pile location and number, type and size of hammer used, type of pile driving cap used, rate of operation of pile driving equipment, pile dimensions, elevation of point, elevation of butt before and after cut-off, ground elevation, continuous record of number of blows for each foot of penetration, pile deviation, measured heave and re-strike, and any unusual occurrences during pile driving. Owner shall pay for Testing Agency Services to monitor driving operations and compile driving records.
 - 1. The pile-driving record shall be provided as a neat, orderly, daily pile driving report.
 - 2. The report shall identify each pile with a number that corresponds to a numbered pile plan submitted prior to the driving operations.
- G. As-Driven Pile Locations: An "As-Built" survey of pile locations, performed by a Louisiana Registered Land Surveyor shall be provided by the Contractor. Piles shall be located horizontally to column lines or foundation edges and vertically referenced to finish floor elevation 0'-0". Indicate as-built location of each pile relative to specified location per plans.
- H. Field quality-control reports.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piles to project site in such quantities and at such times to assure continuity of pile driving operations to project schedule.
- B. Store piles in orderly groups above ground and blocked during storage to prevent distortion of members. Piles exhibiting variations beyond tolerance limits will be considered distorted and may not be used in the work.

1.8 JOB CONDITIONS

- A. Site information: Data on indicated subsurface conditions are not intended as representations or warranties of such conditions. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn there from by Contractor. The data is made available for convenience of Contractor. Geotechnical Report may be reviewed at Architect's Office.
 - 1. Additional test borings and other exploratory operations may be made by Contractor at no additional cost to Owner.

- B. Protection of Property: The Contractor shall document the conditions of existing paving, structures, sewers, above ground utilities, buried utilities, and other property on and adjacent to the work site and shall take suitable, proper, and necessary precautions to protect such property from damage which could result from pile driving operations or associated work. Should damage occur due to Contractor's operations, the Contractor shall bear the responsibility and cost for repairing or replacing the damaged work to its original condition, without additional compensation.
1. Documentation: Photograph existing conditions of structures, finishes, equipment, and adjacent improvements that might be construed as damage resulting from pile driving operations. File photo with Architect before starting pile driving.
 2. Locate Existing Utilities: Coordinate the location of all existing underground utilities with the owner. Locate full extent of all existing buried utilities, such as existing sewer lines, existing water lines, existing gas lines, existing power lines, etc, by nondestructive means prior to performing any site work. If the location of any existing utilities, which are to remain, come within 1'-0" of conflicting with placement of new construction, including piles, the Contractor is to notify the Architect and provide a detailed, dimensioned sketch, prepared by the Contractor, showing the field determined location and elevation of such utilities relative to the building. Such subsurface investigations are to be conducted in a timely manner such that the project schedule is not impacted.
- C. Provide surveyed elevation bench marks on structures where directed by Architect before commencing work, when structures are adjacent to pile driving operations. Recording and report elevation of each bench mark after driving each pile and at least twice a day while pile driving is in progress. Should bench mark readings indicate displacement, halt driving operations until corrective action has been provided and is acceptable to Architect

PART 2 - PRODUCTS

2.1 TIMBER PILES

- A. Round Timber Piles: ASTM D 25, unused, clean peeled, one piece from butt to tip; of the following species and size basis:
1. Species: Southern yellow pine.
 2. Size Basis: See structural plans.
- B. Pressure-treat round timber piles according to AWWA C3 as follows:
1. Service Condition: Foundation.
 2. Treatment: Oil-borne preservative.
 3. Treatment required: 0.80 CCA Treatment
- C. Field-Applied Wood Preservative: Treat field cuts, holes, and other penetrations according to AWWA standard M4.
- D. Pile Butt: Trim pile butt and cut perpendicular to longitudinal axis of pile. Chamfer and shape butt to fit tightly to driving cap of hammer.

2.2 DRIVING EQUIPMENT

- A. General: Provide pile driving equipment of type generally used in standard pile driving practice, operated at manufacturer's specified rate, to development required rated energy per blow.
- B. Hammer: Provide pile driving hammers of sufficient capacity, size and type able to deliver consistently effective dynamic energy, suitable to piles to be driven and to subgrade material into which they are to be driven, when operating at not less than 75% efficiency of rated driving energy. Use a Vulcan No. 1 or equivalent hammer to develop 15,000 foot-pounds of energy.
- C. Driving Caps: Equip hammer with cast steel or structural steel driving cap, with grooved base conforming to pile shape. Keep bearing surfaces of grooves true and smooth.

- D. Pile Cushion (optional): Pile cushion may be used by Contractor if deemed necessary to avoid damage to pile. Submit details of cushion if used.
- E. Leads: Use fixed or rigid type pile driver leads that will hold pile firmly in position and alignment, and in axial alignment with hammer. Extend leads to within 2 ft. of elevation at which the pile enters ground.
- F. Follower: A member between the hammer and the pile to transmit blows to the pile when the top of the pile is below the reach of the hammer.

PART 3 - EXECUTION

3.1 PRE-DRIVING WORK

- A. Site Conditions: Do not drive piles until earthwork operation in area which piles are to occupy has been coordinated with General Contractor.
 - 1. All required fill for building pad shall be placed and compacted prior to driving of piles.
- B. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch intervals; label the distance from pile tip at 60-inch intervals.

3.2 PROBE PILE

- A. Provide two probe piles at locations directed by the structural engineer.
- B. Drive all probe piles to the refusal criteria noted in these specifications. Drive probe piles in accordance with the criteria from the DRIVING PILES section of this specification.
- C. One probe pile will be used as a static test pile based on the results of the driving criteria encountered.

3.3 STATIC TEST PILE

- A. General: Static pile test(s) will be used to confirm allowable design load of piles.
 - 1. Furnish test pile (or piles) for length indicated on plans.
 - 2. Determination of actual length of piles will be based on results of static pile test(s) and probe piles. Do not order production piles until length of pile has been verified based on static test results.
- B. Pile Tests: Arrange and perform the following pile test(s):
 - 1. Axial Compressive Static Load Test: ASTM D 1143-07. Use Procedure A for Quick Test.
 - 2. Pile shall be loaded to the design load of 12 tons and then unloaded to 0 tons. Pile shall then be reloaded to 36 tons (i.e. three times the design load). Submit a detailed loading scheme to the Structural Engineer and Architect for review prior to commencing the static load test.
- C. The load shall be applied by means of an accurately calibrated hydraulic jack, and load cell acting concentrically with and directly on the head of the pile. All materials required for testing, including the reaction piles (also termed anchor piles), frame, cap plate, etc., with the exception of the hydraulic jack, shall be furnished and installed by the Contractor. The furnishing and installing of the hydraulic jack and the actual load testing will be performed by the independent Testing Agency.
 - 1. The Contractor will be required to submit to the Architect for approval, detailed plans of the loading apparatus (including the reaction pile, frame, cap plate, etc.). A civil engineer licensed in Louisiana shall provide the design of the loading apparatus. The engineer shall provide stamped drawings and calculations for the loading apparatus. The testing apparatus shall be designed to allow the various increments of load to be placed without causing vibration in the test pile.
 - a. Contractor shall coordinate the configuration of the loading apparatus with the Testing Agency to accommodate the hydraulic jack and load cell.

- b. The test load shall be applied by hydraulic jack(s) acting against an anchored reaction frame in a configuration similar to Figure 1 of ASTM D 1143.
 2. The loading apparatus (including reaction piles and frame) shall be capable of safely resisting the maximum test load. The reaction piles shall be no closer than eight (8) feet to the test pile, measured from edge to edge of piles.
 3. Allow a minimum of fourteen (14) days to elapse after driving test piles before starting pile testing.
 4. Notify Architect at least 48 hours in advance of performing test(s).
 5. Number of Test Piles: As indicated on plans.
 6. On completion of testing, Contractor shall remove testing structure, equipment, and instrumentation. Reaction piles shall be left in place and shall be cut-off 2'-0" below the bottom of the structure directly above the pile or 2'-0" below finish grade if located outside of the limits of the structure.
 - D. Driving Test Piles: Drive test piles at locations indicated to the refusal criteria indicated herein. Use test piles identical to those required for Project and drive with appropriate pile-driving equipment operating at rated driving energy to be used in driving permanent piles.
 - E. Test Pile-Driving Records: Prepare driving records for each test pile, compiled and attested to by a qualified professional engineer. Include same data as required for driving records of permanent piles.
 - F. Test piles that comply with requirements, including location tolerances, may be used on Project.
- 3.4 DRIVING PILES**
- A. General: Continuously drive piles to elevations or penetration resistance indicated.
 1. Establish and maintain axial alignment of leads and piles before and during driving. Take care during driving to prevent and to correct any tendency of piles to twist or rotate
 2. Carefully maintain center of gravity for each group or cluster of piles to conform to locations shown on drawings.
 3. When handling and driving long pile, take special precautions to ensure against overstress or leading away from a true position when driving. When high-resistant strata lying near the surface must be penetrated, spud piles may be used, when authorized by Architect, to minimize hard driving of long piles during early stages of driving operations.
 4. Pile driving may cease when the blow count with a Vulcan No. 1 hammer is ± 35 blows per foot or 25 blows per foot for two consecutive feet, otherwise, drive the pile to within 1' of cut-off elevation (or full length of pile indicated). Contractor is responsible for all costs associated with stopping driving at this blow count refusal i.e., pile cut offs, cap excavations, cut-off disposal, etc.
 5. If a follower is required to drive pile to final elevation, the follower shall be used immediately during installation of each pile to maintain continuous driving operation prior to installing the next pile.
 - B. Predrilling: Not allowed.
 - C. Heaved Piles: Provide recorded instrument observations made during pile driving to determine whether driven pile has lifted from its original seat during driving of adjacent piles. If uplift occurs, re-drive affected piles to point elevation at least as deep as original point elevation with a driving resistance at least as great as original driving resistance.
 - D. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:

1. Location: 3 inches (after pile driving is completed) from location indicated for center of gravity of each single pile or pile group; 2 inch for piles under grade beams.
 2. Plumb: Maintain 1 inch in 10 feet from vertical, or a maximum of 4 inches, measured when pile is aboveground in leads.
- E. Damaged or mis-driven Piles: Damaged piles, and piles driven outside required driving tolerance will not be accepted.
1. Immediately remove and replace a pile that is not within the required tolerances, damaged, deflected, broken, or which cannot be driven to proper elevation. Replace such pile with an acceptable substitute pile at the location determined by the Architect. In the event that such pile removal should prove to be impossible, abandon the defective pile and replace it with additional pile(s) driven close to the abandoned one as directed by the Architect.
 2. Drive additional pile or piles where centerline deviation exceeds 3" and redesign indicates load on any pile exceeding 110% of design load.
 3. Solidly fill spaces left by withdrawn piles, that will not be filled by new piles, using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact throughout length of space
- F. Defective Pile: Any substantial sudden increase in the rate of penetration of a timber pile shall be investigated for possible damage. If the sudden increase in rate of penetration cannot be correlated to the soil strata, the pile shall be removed for inspection or rejected.
- G. Cutting Off: Cut-off tops of driven piles, square with pile axis and at elevations indicated. Dispose of excess materials off site. Owner reserves first rights of refusal to pile cut-offs.
- H. Pile-Driving Records: Maintain accurate driving records for each pile.

3.5 VIBRATION MONITORING

- A. Pile driving will cause vibrations that may affect nearby buildings and utilities. Pile driving operations shall be continuously monitored at any structure of concern during the driving of all job piles to record their magnitude of vibrations.
1. Owner shall engage a testing agency to provide continuous vibration monitoring during pile driving operations.
 2. The peak particle velocity of earth between the driving operation and adjacent structures during pile driving shall be 0.25 inch per second or less. If sustained peak particle velocity exceeds 0.25 inch per second, the Contractor shall terminate driving operations.

3.6 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
1. Pile foundations.
- B. Pile Design Load: Design load per pile is 12 tons.

END OF SECTION 31 62 19

SECTION 32 1313 - CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes exterior concrete paving for the following items:
 - 1. Driveways.
 - 2. Parking lots.
 - 3. Sidewalks.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. 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. Do not combine mix designs or product data with submittals for cast-in-place concrete. Information relevant to concrete pavement shall be submitted under separately and under this specification section number.

1.3 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
- C. Reinforcing Bars: ASTM A615, Grade 60; deformed.
- D. Joint Dowel Bars: ASTM A615, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.

2.3 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - 1. Portland Cement: ASTM C150, Type I or Type II.
 - 2. Fly Ash: ASTM C618, Class F.
 - a. Product shall be restricted to suppliers and sources provided on LA DOTD QPL 50.
- B. Aggregates: ASTM C33, uniformly graded. Provide aggregates from a single source.
 - 1. Maximum aggregate size: No greater than 1/4 of the depth of each respective slab thickness.
- C. Air-Entraining Admixture: ASTM C260.
- D. Chemical Admixtures: ASTM C494. 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.
- E. Water: Potable and complying with ASTM C94.

2.4 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth.
- 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.
- E. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.5 RELATED MATERIALS

- A. Joint Fillers:
 - 1. Clear heart redwood in accordance with LADOTD Standard Specification section 1005.01.2.
- B. Cold-Applied Joint Sealants:
 - 1. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, non-sag silicone sealant complying with ASTM D5893 for Type NS.
 - a. Product shall be restricted to suppliers and sources provided on LA DOTD QPL 42.
 - 2. Type SL Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D5893 for Type SL.

- a. Product shall be restricted to suppliers and sources provided on LA DOTD QPL 42.
- C. Joint-Sealant Backer Materials:
 - 1. Round Backer Rods for Cold-Applied Sealants: ASTM D5249, Type 3, of diameter and density require to control sealant depths and prevent bottom-side adhesion of sealant.
- D. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.6 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type, strength, and thickness of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
 - 1. Fly Ash or Pozzolan: 20 percent.
- 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: 4.5 percent plus or minus 1-1/2 percent.
- D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing 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.
- E. Concrete Mixtures: Normal-weight concrete.
 - 1. Compressive Strength (28 Days):
 - a. Pavement and barrier curbs: 4000 psi.
 - b. Sidewalks: 3000psi.
 - 2. Maximum W/C Ratio at Point of Placement: 0.45.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
 - a. Slump limit may be adjusted if water-reducing admixtures are used.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proof-roll prepared subbase surface below areas of proposed concrete pavements in accordance with Specification Section 31 20 10, "Earth Moving (Site)" to identify soft pockets and areas of excess yielding.

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 INSTALLATION

- A. 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.

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.
- 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.
- 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.
- 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.

- 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. 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.
- B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- C. 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.
- D. Screed paving surface with a straightedge and strike off.
- E. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

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 bleedwater 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.

3.8 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 darbing 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 methods.

3.9 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 - 1. Elevation: 1/4 inch.
 - a. Maximum variations in surface tolerance shall not exceed 1/4 inch in 10 feet.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Joint Spacing: 3 inches.
 - 4. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 5. Joint Width: Plus 1/8 inch, no minus.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172 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 C143; 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 C231, 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 C1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
 - 5. Compression Test Specimens: ASTM C31; cast and laboratory cure one set of four standard cylinder specimens for each composite sample. One specimen shall be retained for later testing, if required.
 - 6. Compressive-Strength Tests: ASTM C39; 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 individual 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.
 - 1. Concrete paving that has been determined to be defective shall be replaced at no additional cost to the Owner.
- 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.

3.11 REPAIR 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 Architect.
- B. 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.
- C. 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 32 1313

SECTION 32 1723 - 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 concrete 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 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 for alkyd materials, 55 deg F for water-based materials], and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design", the ABA standards of the Federal agency having jurisdiction, and ICC A117.1.

2.2 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type S; colors complying with FS TT-P-1952.
 - 1. Color: As indicated on drawings.
- B. Glass Beads: AASHTO M 247, Type 1.
 - 1. Roundness: Minimum 75 percent true spheres by weight.

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 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.

3.3 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 32 1723

**SECTION 32 3113
CHAIN LINK FENCES AND GATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Posts, rails, and frames.
- B. Wire fabric.
- C. Concrete.
- D. Manual gates with related hardware.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete anchorage for posts.

1.03 REFERENCE STANDARDS

- A. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric; 2011a (Reapproved 2022).
- B. ASTM F567 - Standard Practice for Installation of Chain-Link Fence; 2023.
- C. CLFMI CLF-FIG0111 - Field Inspection Guide; 2014.
- D. FS RR-F-191/1D - Fencing, Wire and Post Metal (Chain-Link Fence Fabric); 1990.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Chain Link Fences and Gates:
 - 1. Master-Halco, Inc; _____: www.masterhalco.com/#sle.
 - 2. Merchants Metals; _____: www.merchantsmetals.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS

- A. Line Posts: 1.9 inch (48 mm) diameter.
- B. Corner and Terminal Posts: 2.38 inch (60 mm) diameter.
- C. Fabric: 2 inch (51 mm) diamond mesh interwoven wire, 6 gauge, 0.1920 inch (4.9 mm) thick, top selvage knuckle end closed, bottom selvage twisted tight.
- D. Tension Wire: 6 gauge, 0.1920 inch (4.9 mm) thick steel, single strand.
- E. Tie Wire: Aluminum alloy steel wire.

2.03 MATERIALS

- A. Posts, Rails, and Frames: _____:
 - 1. Line Posts: Type I round in accordance with FS RR-F-191/1D.
 - 2. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round in accordance with FS RR-F-191/1D.
- B. Wire Fabric: _____:
 - 1. ASTM A392 zinc coated steel chain link fabric.
- C. Concrete: _____:
 - 1. Type specified in Section 03 3000.

2.04 MANUAL GATES AND RELATED HARDWARE

- A. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches (1,525 mm) high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.
- B. Hinges: Finished to match fence components.
- C. Latches: Finished to match fence components.
- D. Cantilever Gates:
 - 1. Fabricate to dimensions as shown on the Drawings.
 - 2. Finish: Galvanized.

2.05 ACCESSORIES

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.
- C. Extension Arms: Cast steel galvanized, to accommodate 3 strands of barbed wire, single arm, vertical.
- D. Privacy Slats: Aluminum strips, sized to fit fabric weave.
 - 1. Products:
 - a. PrivacyLink; Aluminum Slats: www.eprivacylink.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Finish: Color as selected by Architect from manufacturer's standard range.

2.06 FINISHES

- A. Components and Fabric: Vinyl coated over coating of 1.8 ounces per square foot galvanizing (over coating of 550 g/sq m galvanizing).
- B. Color(s): To be selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Verify that areas are clear of obstructions or debris.
- B. Preinstallation Testing: Test areas for ledge.

3.02 PREPARATION

- A. Removal: Obstructions or debris.

3.03 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm).
- B. Maximum Offset From True Position: 1 inch (25 mm).
- C. Do not infringe on adjacent property lines.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.
- C. Fence Height: Randomly measure fence height at three locations or at areas that appear out of compliance with design.
- D. Gates: Inspect for level, plumb, and alignment.
- E. Workmanship: Verify neat installation free of defects. See CLFMI CLF-FIG0111 for field inspection guidance.

3.06 CLEANING

- A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- B. Clean fence with mild household detergent and clean water rinse well.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.

**SECTION 32 9200
TURF AND GRASSES**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. All references to LADOTD specifications are to the Louisiana Standard Specifications for Roads and Bridges, 2016 Edition.

1.02 SUMMARY

- A. Section Includes:
 - 1. Seeding.
 - 2. Sodding.
 - 3. Erosion-control material(s).
- B. Related Requirements:
 - 1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
 - 2. Section 312010 "Earth Moving (Site)" for excavation, filling, backfilling, and rough grading.

1.03 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating 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.
- C. Product Certificates: For erosion control blanket from manufacturer.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
- B. Installer's Field Supervision: Require installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

1.06 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 compliance with state and Federal laws, as applicable.
- 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" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. 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 materials with appropriate certificates.

1.07 FIELD CONDITIONS

- A. 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.

PART 2 - PRODUCTS

2.01 SEED

- A. Provide seed materials conforming to the following criteria:
 - 1. Grass Seed: Fresh, clean, dry, new-crop seed complying with table 717-1 of LADOTD Specification Section 717.
 - 2. Grass Seed Mix: Seed mix based on the planting dates as follows:
 - a. March to September: Type A
 - b. September to February: Type C
 - c. February to March: Type B

2.02 SOD

- A. Provide seed materials conforming to the following criteria:
 - 1. Rolls or slabs of field grown Bermuda grass in accordance with LADOTD Specification Section 714.

2.03 EROSION-CONTROL MATERIALS

- A. Erosion Control Blanket: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel-wire staples, 6 inches long (minimum).
 - 1. Blanket durability: 12 months (minimum).

2.04 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.
- B. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - 1. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep. Do not obtain from agricultural land, bogs, or marshes.

2.05 FERTILIZER

- A. 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: 1lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
 - 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. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 3. Uniformly moisten excessively dry soil that is not workable or which is 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.

3.02 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.

3.03 TURF AREA PREPARATION

- A. Limit turf subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous material and legally dispose of them off of Owner's property.
 - 1. Apply fertilizer directly to subgrade before loosening.
 - 2. Thoroughly blend planting soil mix off-site before spreading.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within 3 days.
 - 3. Spread planting mix to a depth of 4 inches but not less than required to meet finished grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately $\frac{1}{2}$ the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil mix.
- C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus $\frac{1}{2}$ inch of finished elevation. Roll and rake, remove ridges, and fill depressions to meet finished grades. Limit finished grade to areas that can be planted in the immediate future.
- D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Before planting, restore planting areas if eroded or otherwise disturbed after finish grading.

3.04 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in "Turf Area Preparation" Article.
- B. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- C. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.05 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
 - 1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 2. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of [1-2 lb/1000 sq. ft..
- C. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.

- D. Protect seeded areas with slopes exceeding 1:20 and where indicated on Drawings with erosion-control blankets installed and stapled according to manufacturer's written instructions.

3.06 SODDING

- A. Install rolls or slabs of field grown Bermuda grass sod in accordance with LADOTD Standard Specification section 714.
- B. Water and establish according to LADOTD Standard Specification Section 714.07 and 714.08.

3.07 TURF MAINTENANCE

- A. General: 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 one-third of grass height. Remove no more than one-third 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 grass to a height of 1/2 inch or less.
- D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.
 - 1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.08 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.

3.09 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. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.
- C. 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.
- D. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION

SECTION 33 1416 – SITE WATER DISTRIBUTION

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 water service mains.
- B. All fees assessed by Water Company for tap, service extension, and meters shall be included in the original contract sum.

1.3 DEFINITIONS

- A. PVC: Polyvinyl Chloride
- B. DI: Ductile Iron

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
- C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 - 3. Comply with standards of authorities having jurisdiction 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 authorities having jurisdiction, and marked for intended use.
- D. Comply with ASTM F645 for selection, design, and installation of thermoplastic water piping.
- E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
 - 1. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

1.6 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.

1.7 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 two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of water-distribution service without Owner's written permission.

1.8 COORDINATION

- A. Coordinate connection to water main with utility company.
 - 1. Water Company will provide tap from existing water main, service extension, and water meters.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.
- B. Material specified on drawings supersedes those in this section where applicable.

2.2 PVC PIPE AND FITTINGS

- A. Domestic Service: PVC, Schedule 40 Pipe: ASTM D1785.
 - 1. PVC, Schedule 40 Socket Fittings: ASTM D2466.
- B. Domestic Service: IPS PVC Pressure Pipe: ASTM D2241
- C. Fire Service: PVC, AWWA Pipe: AWWA C900, Class 150, with bell end with gasket, and with spigot end.
 - 1. Comply with UL 1285 for fire-service mains if indicated.
 - 2. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
 - 3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
 - 4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Gaskets: AWWA C111, rubber.
 - 5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.3 JOINING MATERIALS

- A. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.4 GATE VALVES

- A. AWWA, Cast-Iron Gate Valves:
 - 1. OS&Y, Rising-Stem, Metal-Seated Gate Valves:
 - a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.
 - 1) Standard: AWWA C500.
 - 2) Minimum Pressure Rating: 200 psig.
 - 3) End Connections: Flanged.
 - 2. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:

- a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 200 psig.
 - 3) End Connections: Flanged.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

- A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
 - 1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.6 CHECK VALVES

- A. AWWA Check Valves:
 - 1. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
 - a. Standard: AWWA C508.
 - b. Pressure Rating: 175 psig.

2.7 WATER METERS

- A. Water meters will be furnished by Water Company.

2.8 BACKFLOW PREVENTERS

- A. Backflow preventer shall be located immediately downstream of water meter and shall have thermal protection as listed in this section.
- B. Reduced-Pressure-Principle Backflow Preventers:
 - 1. Standard: ASSE 1013, AWWA C511.
 - 2. Operation: Continuous-pressure applications.
 - 3. Size: Shall match service main size indicated on Drawings.
 - 4. Pressure Loss at Design Flow Rate: Coordinate with plumbing engineer for requirements.
 - 5. Body: cast iron or steel with interior lining complying with AWWA C550 or that is FDA approved.
 - 6. End Connections: Flanged.
 - 7. Configuration: Designed for horizontal, straight through flow.
 - 8. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

2.9 PROTECTIVE ENCLOSURES

- A. Freeze-Protection Enclosures:
 - 1. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F when external temperatures reach as low as 0 deg F.
 - a. Standard: ASSE 1060.

- b. Required Class:
 - 1) Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
 - 2) Class I-V: For pressure or atmospheric vacuum breaker equipment or devices.
- c. Housing: Reinforced aluminum construction.
 - a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
 - b) Include drain opening in housing.
 - c) Access doors with locking devices.
 - d) Insulation inside housing.
 - e) Anchoring devices for attaching housing to concrete base.
- d. Electric heating cable or heater with self-limiting temperature control.
 - 1) Certified for wet and damp locations.
 - 2) Coordinate voltage with power feed on electrical plans.

B. Enclosure Bases:

- 1. Description: 4-inch minimum thickness precast concrete, of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Section 31 2010 "Earth Moving (Site)" for excavating, trenching, and backfilling.

3.2 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. Where specific valve types are not indicated, the following requirements apply:
 - 1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, metal-seated gate valves with valve box.
 - 2. Use the following for valves in vaults and aboveground:
 - a. Gate Valves, NPS 2 (DN 50) and Smaller: Bronze, rising stem.
 - b. Gate Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, OS&Y rising stem, metal seated.
 - c. Check Valves: AWWA C508, swing type.
 - 3. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
 - 4. Relief Valves: Use for water-service piping in vaults and aboveground.
 - a. Air-Release Valves: To release accumulated air.
 - b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
 - c. Combination Air Valves: To release or admit air.

3.3 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.
- B. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
- C. Bury piping with depth of cover over top at least 36 inches, with top at least 12 inches below level of maximum frost penetration.
- D. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- E. 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.
- F. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.4 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
 - 1. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
 - 2. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - a. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.
 - b. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples.

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. Locking mechanical joints.
 - 3. Set-screw mechanical retainer glands.
 - 4. Bolted flanged joints.
 - 5. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 - 1. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
- 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.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.
- E. MSS Valves: Install as component of connected piping system.
- F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.
- G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves. Install full-size valved bypass.
- H. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.7 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.

3.8 PROTECTIVE ENCLOSURE INSTALLATION

- A. Install concrete base level and with top approximately 2 inches above grade.
- B. Install protective enclosure over valves and equipment.
- C. Anchor protective enclosure to concrete base.

3.9 CONNECTIONS

- A. Connect water-distribution piping to utility water main extension.
- B. Connect water-distribution piping to interior domestic water piping.

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. Backflow preventers shall be tested in accordance with International Plumbing Code Section 312.10 and all referenced standards.
- D. 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 31 20 00 "Earth Moving."
- B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel.

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 33 1416

SECTION 33 3113 - SITE SANITARY SEWER

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. PVC pipe and fittings.
 - 2. Expansion joints and deflection fittings.
 - 3. Cleanouts.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Pipe and fittings.
 - 2. Non-pressure couplings
 - 3. Expansion joints and deflection fittings.
 - 4. Cleanouts.
- B. Field quality-control reports.

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.

1.5 FIELD 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 Architect no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

- A. PVC Type PSM Sewer Piping:12454

1. Pipe: ASTM D 3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.2 EXPANSION JOINTS AND DEFLECTION FITTINGS

- A. Ductile-Iron, Flexible Expansion Joints:
 1. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.
- B. Ductile-Iron Expansion Joints:
 1. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include rating for 250-psig minimum working pressure and for expansion indicated..
- C. Ductile-Iron Deflection Fittings:
 1. Description: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.

2.3 CLEANOUTS

- A. Cast-Iron Cleanouts:
 1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
 2. Top-Loading Classification(s): Medium Duty and Extra-Heavy Duty.
 3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.
- B. 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 31 2010 "Earth Moving (Site)".

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details to 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. 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 using lubricants, cements, and other installation requirements.
- C. Install cleanouts at changes in direction. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
 - 2. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 3. Install ductile-iron, gravity sewer piping according to ASTM A746.
- G. 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 Type PSM sewer piping according to ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasket joints.
 - 2. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
- B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
 - 1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. Unshielded flexible couplings for pipes of same or slightly different OD.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
 - 2. Use pressure pipe couplings for force-main joints.

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 use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Medium-Duty, top-loading classification cleanouts in unpaved areas.
 - 2. Use Extra-Heavy-Duty, top-loading classification cleanouts in all paved areas.

- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.
- C. 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 22 13 00 "Sanitary Waste and Vent Storm Drainage".

3.6 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 and the following:
 - a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
 - b. Close openings in system and fill with water.
 - c. Purge air and refill with water.
 - d. Disconnect water supply.
 - e. Test and inspect joints for leaks.
 - 6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Test plastic gravity sewer piping according to ASTM F 1417.
- 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.

3.7 CLEANING

- A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 33 3113

SECTION 33 4200 – SITE STORM DRAINAGE

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.
- B. All references to LADOTD specifications are to the Louisiana Standard Specifications for Roads and Bridges, 2016 Edition.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Cleanouts.
 - 3. Stormwater inlets and manholes.

1.3 SUBMITTALS

- A. Product Data: For drainage structures, pipes, and fittings.
- B. Shop Drawings:
 - 1. All drainage structures shall be identified by the designations provided on the construction drawings.
 - 2. Manholes: Include plans, top and invert elevations, pipe elevations, sections, details, reinforcement, frames, and covers.
 - 3. Stormwater inlets: Include plans, top and invert elevations, pipe elevations, sections, details, reinforcement, frames, and grates.
 - 4. Subsurface stormwater detention systems: Include plans, top and invert elevations, pipe connection locations and elevations, inlet locations and elevations, sections, and details.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 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 in accordance with manufacturer's written rigging instructions.

- D. Handle stormwater inlets in accordance with manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 PLASTIC PIPE AND FITTINGS

- A. PVC Gravity Sewer Piping:
 - 1. Pipe and Fittings: ASTM F 949, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.
- B. High-Density Polyethylene (HDPE) Gravity Pipe And Fittings
 - 1. Pipe and Fittings: Pipe and Fittings: ASTM F 2306, HDPE gravity-flow storm sewer pipe with integral bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.
- C. Polypropylene (PP) Gravity Pipe And Fittings
 - 1. Pipe and Fittings: ASTM F 2881, HDPE gravity-flow storm sewer pipe with integral bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.2 CONCRETE PIPE AND FITTINGS

- A. Reinforced-Concrete Pipe and Fittings
 - 1. Provide in accordance with LADOTD specification Section 701 and all referenced sections.

2.3 CLEANOUTS

- A. Cast-Iron Cleanouts:
 - 1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug.
 - 2. Top-Loading Classification(s): Medium and Extra-Heavy Duty
 - 3. Pipe Fitting and Riser to Cleanout: PVC Schedule 80 or SDR 35 plastic pipe and fittings.

2.4 PRE-CAST CONCRETE DRAINAGE STRUCTURES

- A. Provide structures in accordance with plans, conforming to dimensions, reinforcement, and appurtenances as indicated.
- B. Standard Precast Concrete Drainage Structures:
 - 1. Description: ASTM C 913, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
 - 3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.

4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into structure walls, for each pipe connection.
- C. Manhole Frames and Covers:
 1. Description: Ferrous; 24-inch inside diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
 2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.
- D. Stormwater Inlet Frames and Grates: Include flat grate with short-slotted drainage openings.
 1. Size: 24 by 24 inches minimum unless otherwise indicated.
 2. Grate Free Area: Approximately 50 percent unless otherwise indicated.
 3. Material: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading.

2.5 POLYMER STORMWATER STRUCTURES

- A. Provide structures in accordance with plans, conforming to dimensions, materials, and appurtenances as indicated.
- B. Polymer Drainage Structures:
 1. Description: ASTM D1784, Polyvinyl Chloride, of depth indicated, with provision for sealant joints.
 2. Joint Sealant: ASTM F477
 3. Pipe Connections: ASTM D3212, fitted into connection stubs provided on basin channel.
 4. Bedding Material: ASTM D2321, placed to dimensions required by manufacturer and uniformly compacted.
- C. Frames and Grates for Inlets: Provide square frame and grate fitted onto circular basin channel.
 1. Size: As indicated on drawings.
 2. Grate Free Area: Approximately 50 percent unless otherwise indicated.
 3. Material: ASTM A536, Grade 70-50-05, ductile iron designed for AASHTO H10-44 or HS20-44 structural loading.

2.6 CONCRETE

- A. General: Cast-in-place concrete in accordance with ACI 318, ACI 350, and the following:
 1. Cement: ASTM C 150/C 150M, Type II.
 2. Fine Aggregate: ASTM C 33/C 33M, sand.
 3. Coarse Aggregate: ASTM C 33/C 33M, 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 1064/A 1064M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 312010 "Earth Moving (Site)".

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 in accordance with 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 proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Stormwater runoff shall not be directed towards or allowed to shed into open pipe trenches.
- G. Adequate ground cover, as determined by manufacturer, shall be provided over installed pipe to prevent flotation. If adequate depth cannot be achieved, anchor system per manufacturer's recommendation shall be provided at no additional cost to Owner.
- H. Install gravity-flow, nonpressure drainage piping in accordance with the following:
 - 1. Install piping pitched down in direction of flow.
 - 2. Install PVC sewer piping in accordance with ASTM D 2321 and ASTM F 1668.
 - 3. Install reinforced-concrete sewer piping in accordance with ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping in accordance with the following:
 - 1. Join PVC corrugated sewer piping in accordance with ASTM D 2321 for elastomeric-seal joints.
 - 2. Join PVC sewer piping in accordance with ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
 - 3. Join perforated PVC sewer pipe and fittings according to ASTM D3212 with loose bell-and-spigot, push-on joints.
 - 4. Join reinforced-concrete sewer piping in accordance with ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
 - 5. Join dissimilar pipe materials with nonpressure-type flexible couplings.
- B. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.4 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use plastic pipe fittings in sewer pipes at branches for cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Medium Duty top-loading classification cleanouts in areas of grass, landscaping, or that will be subject to foot traffic only.
 - 2. Use Extra-Heavy Duty top-loading classification cleanouts in areas of proposed vehicular use.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 DRAINAGE STRUCTURE INSTALLATION

- A. General: Install manholes and inlets, complete with appurtenances and accessories indicated.
- B. Install precast drainage structure sections with sealants in accordance with ASTM C 891.
- C. Where specific drainage structure construction is not indicated, follow manhole manufacturer's written instructions.
- D. Precast Concrete Manholes:
 - 1. 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.
- E. Precast Concrete Inlets:
 - 1. Construct catch basins to sizes and shapes indicated.
 - 2. Set frames and grates to elevations indicated.

3.6 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 reports 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 in accordance with 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. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
 - b. Option: Test plastic piping in accordance with ASTM F 1417.
- 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.
- E. Maintain stormwater pollution prevention measures at each drainage structure and conveyance system throughout project duration. Clean interior of piping and drainage structures of dirt and superfluous materials (do not flush into outfall system).

END OF SECTION 33 4200

