

PROPOSAL

FOR

TAS 25-9A D215012

MANCHESTER MAINTENANCE SECTION – BUILDING
ADDITION AND ROOF REPLACEMENT
MILEPOST 340.20

BOOK 1 OF 1

THIS BOOK CONTAINS SPECIFICATIONS AND
BID PROPOSAL WORKSHEETS

SUBMITTED IN ACCORDANCE WITH THE NEW YORK STATE
DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS
OFFICIALLY ADOPTED SEPTEMBER 1, 2025 EXCEPT AS MODIFIED
IN THE PLANS AND/OR PROPOSAL AND ANY CHANGES WITH
ARTICLE 2, TITLE 9 OF THE PUBLIC AUTHORITIES LAW.

LETTING OF
SEPTEMBER 24, 2025

BIDS DUE: 10:30 A.M.

BIDS OPEN: 11:00 A.M.



**Thruway
Authority**

200 Southern Blvd., Albany, NY 12209

NOTICE **TO** **BIDDERS**

In addition to the bid deposit requirement, this Proposal shall be accompanied by a Statement of Surety's Consent on the form furnished by the Authority. (See last page).

BIDDERS ARE SUBJECT TO LOSS OF BID DEPOSIT FOR FAILURE TO OBTAIN PROPER BONDING.

Thruway Authority Designated Contacts

Pursuant to NYS Finance Law Sections 139-j and 139-k, the following people are the designated contacts for this procurement process:

For all technical or engineering related questions:

- Nicholas Tario, R.A.
Project Designer
Nicholas.Tario@thruway.ny.gov

Or

- Dan Livermore, P.E.
Deputy Director, Structures Design Bureau
Dan.Livermore@thruway.ny.gov

For all procurement contract process related questions:

- Kelly Galvin
Office of Procurement Services
Kelly.Galvin@thruway.ny.gov

Or

Jonathan Hill
Deputy Director of Capital and Contracts Management
Office of Procurement Services
Jonathan.Hill@thruway.ny.gov

For more information about NYS Finance Law Sections 139-j and 139-k, please see the New York State Thruway Authority Guidelines for Lobbying included in this Proposal.

NEW YORK STATE THRUWAY AUTHORITY

NOTICE TO BIDDERS

Sealed bids must be hand delivered, or delivered by first class mail, USPS Express or Priority Mail, or overnight delivery service (e.g., FedEx, UPS) to the New York State Thruway Authority Headquarters Building, at the following address only: New York State Thruway Authority, 200 Southern Boulevard Albany, NY 12209.

Sealed bids should not be sent or delivered to any other address or location, and the Authority is not responsible for any late deliveries or misdirected bids.

Regardless of the delivery method selected, all sealed bids, whether paper or electronic form, must be delivered by 10:30 AM, on Wednesday, September 24, 2025, where they will be opened publicly and read aloud at 11:00 AM. Any bids sent or delivered to an address or location other than the one specified above, or received after this time, will not be accepted.

Contract TAS 25-9A / D215012 Manchester Maintenance Section – Addition and Roof Replacement at MP 340.20 in Ontario County in accordance with the Plans and Specifications.

Your bid must be secured with either a Bid Bond or a Bid Deposit. A Bid Bond must be in the amount of 5% of the total bid and must be on the Authority's Bid Bond Form (TA-44117) which is included in the Proposal. A Bid Deposit must be a certified check or cashier's check made payable to the New York State Thruway Authority in the amount of **\$75,000.00.**

Plans, proposals, and information on how to download Contract Bid Data are available on the Authority's Website at www.thruway.ny.gov.

SPECIAL NOTE

The New York State Thruway Authority has discontinued the practice of reproducing and furnishing full-size and half-size plans to Contractors after contract award. Contractors shall be responsible for their own hard copies of plans and proposals at no additional cost to the Authority.

New York State Can Help You Secure Surety Bonding

The NYS Surety Bond Assistance Program (NYSBAP) provides technical and financial assistance to help contractors secure surety bonding. Contractors may be eligible to receive a guarantee of up to 30% to secure a surety bond line, bid bond or a performance and payment bond on State projects. Training is also available to contractors requiring technical support on how to become bond-ready. For more information and to fill out a NYSBAP application, visit <http://esd.ny.gov/BusinessPrograms/BondingAssistance.html> or contact Ms. Huey-Min Chuang at Empire State Development at 212-803-3238 or BAP@esd.ny.gov.

SPECIAL NOTE
REQUEST FOR INFORMATION (RFI)

A **request for information (RFI)** is a written process used to clarify a detail, specification, or note in the contract documents, provide notification of a possible error or omission, or request a minor modification due to possible unforeseen issues that may occur during construction.

However, during the period between project advertisement and award of contract, the prospective Bidder/Contractor shall submit all RFIs to the appropriate “Designated Contact” via e-mail, as listed elsewhere in the Proposal. The prospective Bidder’s/Contractor’s RFI shall be forwarded to the designated contact. The Bidder Request for Information, Thruway Authority form TA-W44137, can now be found on the Authority’s website at:

<http://www.thruway.ny.gov/business/contractors/documents/ta-w44137.pdf>

This form should be filled out as completely and accurately as possible, numbered sequentially, as may be necessary, and saved in pdf format. Any supporting information that may help describe the issue more clearly, as well as any suggestions or recommendations for possible resolution, should also be provided. The form once complete shall be forwarded to the designated contact as instructed in the form.

Responses by the Authority to RFI’s will be documented as Questions and Answers and posted for all bidders’ reference, under each respective project, on the Thruway Authority’s website at:

<http://www.thruway.ny.gov/business/contractors/documents/index.shtml>

Questions and Answers posted to the Authorities internet page may not be memorialized as amendments. Thus, prospective bidders are advised to check the Thruway Authority’s website regularly before letting (or proposals are due), for Questions and Answers updates. Please be advised that RFI’s submitted the week of the letting may not be answered.

Any changes to the Contract documents that result from an RFI will be addressed via an amendment.

New York State Thruway Authority

Contract No. TAS 25-9A

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PROJECT INFORMATION

NEW YORK STATE THRUWAY AUTHORITY
DEPARTMENT OF ENGINEERING
PROPOSAL ESTIMATE FOR
MANCHESTER MAINTENANCE SECTION
BUILDING ADDITION AND ROOF REPLACEMENT
AT
MILEPOST 340.20
IN THE
SYRACUSE DIVISION
OF THE
NEW YORK STATE THRUWAY
IN
ONTARIO COUNTY

TYPE	LIMITS
Renovations (Addition) and Roof Replacement to the Manchester Section Maintenance Building	Milepost 340.20

DEPOSIT REQUIRED \$75,000.00

COMPLETION DATE December 31, 2026

PRE-AWARD NOTICE

A Pre-Award Meeting has not been scheduled for this project. If a Pre-Award Meeting is deemed necessary, notice of the date and time will be provided.

To assist the Authority in its award process, the successful low bidder must furnish the following items upon request:

1. A current New York State Uniform Contracting Questionnaire (NYSUCQ) CCA-2 form must be on file;
2. A list of current contracts giving the firm or agency for which they are being performed, the name and phone number of someone therein familiar with the contractor's work, the contract amount, and percent of completion;
3. Pre-Award Project Schedule;
4. Documentation of the actions taken to comply with the Minority/Women's Business Enterprise Utilization goals (Non-Federal), or Disadvantaged Business Enterprise goals (Federal) as defined in the Proposal;
5. A "Schedule of Participation of Minority/Women's Business Enterprise" (Form TA-1022), or Disadvantaged Business Enterprise" (Form TA-1022F);
6. AAPHC-89 Approval to Subcontract.

Contract Documents will be supplied with the Authority's notice to the successful low bidder and must be executed and returned to the Authority within ten (10) days of receipt.

If a Pre-Award Meeting is held, it is requested that the Project Superintendent be present. The Contractor should be prepared to provide, upon request by the Authority, information regarding, among other things, the following:

1. Use of subcontractors, including who they will be and what items of work they will perform;
2. Suppliers and manufacturers;
3. Traffic control and safety;
4. Any anticipated problems that could affect the progression of the project.

CONTRACT AWARD

The award process cannot begin until the executed Contract Documents have been returned to the Authority and the successful Low Bidder has provided acceptable documentation with regard to his actions taken to comply with the M/WBE goals of this Contract or DBE Goals for Federally Aided Contracts.

ALL BIDDERS**PRE-BID INSPECTION**

The prospective bidder must have in its possession the Contract Plans/Proposal and a Work Permit for identification purposes when conducting a pre-bid inspection of the Thruway facility.

The prospective bidder shall inform the appropriate Division Point of Contact (listed below) prior to visiting the site and shall strictly comply with all instructions and requirements.

- **The New York State Thruway Authority Permit Application (TA-W5124)** and information on required insurance documentation is available at <http://www.thruway.ny.gov/business/realproperty/permits.html>. The application along with insurance documentation shall be submitted to the appropriate Thruway Authority Division Permit Coordinator as indicated on page 2 of the application. The fee is waived for this Pre-Bid Inspection.

<u>Division</u>	<u>Point of Contact</u>	<u>Phone</u>
New York	Timothy Mathew	(845) 918-2510
Albany	Michael Beaudet	(518) 471-5940
Syracuse	Jerrin George	(315) 438-2391
Buffalo	Nicholas Przybylski	(716) 635-6253

Provisions of Section 107-05, Equipment Safety Procedures, contained in the Contract Proposal shall apply to all Pre-Bid Inspectors and shall be strictly adhered to while performing the pre-bid inspection.

PRECONSTRUCTION MEETING

A Pre-Construction Meeting will be held prior to the start of construction. The time, date and location will be coordinated by the Division Construction Engineer who will provide this information to the successful low bidder as soon as it is available.

WITHDRAWAL OF BID

A Contractor may at any time, upon at least fifteen (15) days written notice, withdraw its bid on a date sixty (60) days after bid opening or thirty (30) days after the properly executed contract documents have all been received by the Authority, whichever is later. The bid bond, bid deposit, and/or performance bond shall remain in effect until such period of written notice has expired provided the contract has not been approved by the Office of the State Comptroller in the interim.

The Contractor and the Authority may agree in writing to extend the date upon which the bid may be withdrawn if the contract has not been approved by the Office of the State Comptroller.

WORK TO BE DONE

The following is a general description of the work to be done under this Contract. This list is intended to give the Contractor a general description of the work involved in this Contract and is not a complete listing of all work to be done. All work shall be done in accordance with the Contract Documents even though not specifically mentioned in this list.

The scope of the work is twofold. First, an addition to the existing Manchester maintenance section building will be constructed. This addition will have an expanded locker room, cafeteria, and restrooms in order to better accommodate the building's employees. Second, a new EPDM roof will be provided to the Manchester maintenance section building. The existing roof is in poor condition and needs to be replaced. The act of replacing this roof will also involve asbestos abatement, concrete deck repair, and selected structure demolition.

SCHEDULE AND SUSPENSION OF WORK

The New York State Thruway is a limited access, high-speed, high-volume highway. Traffic shall be maintained in accordance with the *Manual on Uniform Traffic Control Devices (MUTCD)*, the *Work Zone Traffic Control Plans*, the *Standard Specifications* Section 619 and the following provisions:

A. WORK ZONE TRAFFIC CONTROL

1. Lane closures on the Thruway shall only be allowed in accordance with the traffic management table(s), available on the Thruway Authority website at <http://www.thruway.ny.gov/business/contractors/standard-sheets/index.shtml>, unless indicated otherwise in the contract documents. If more than one table is applicable to a work zone location, the most restrictive requirements shall be used. Traffic management tables do not guarantee lane closure availability; the requirements of Section B. *Work Restrictions* shall supersede these tables, when applicable.
2. Lane closures on the Thruway will be permitted for work site access, delivery of materials and equipment, and work operations. Personal vehicles will **NOT** be allowed to park along the Thruway or within lane closures on the Thruway at any time. During non-working hours, all equipment and materials shall be stored at least 30 feet from the edge of pavement (both mainline and ramps) or be protected by a physical barrier approved by the Engineer.
3. Lane closures will **NOT** be permitted during holiday periods or when unforeseen circumstances arise, as described in Section B. *Work Restrictions*, unless indicated otherwise in the contract documents.
4. Lane closures will **NOT** be permitted for the sole convenience of the Contractor. Lane closures will be permitted in order to protect traffic from an actual hazard, as determined by the Engineer.
5. Permanent lane closures will **NOT** be permitted for the duration of the contract.
6. Simultaneous closure of right and left shoulders will **NOT** be permitted unless indicated otherwise in the contract documents. Either right or left shoulder must remain clear and available through all work zones. The open shoulder shall not be used for the storage of vehicles, equipment, supplies or any other obstructions, or for any work activity.
7. Ramp closures will **NOT** be permitted, unless indicated otherwise in the contract documents. Access to interchanges, service areas and parking areas shall be maintained at all times.
8. Traffic will **NOT** be permitted to drive on milled pavement, unless indicated otherwise in the contract documents.

B. WORK RESTRICTIONS

1. **HOLIDAY PERIODS.** Lane closures will **NOT** be permitted during holiday periods, unless indicated otherwise in the contract documents. The Authority may permit work on Thruway facilities only if operations do not inhibit or distract traffic. Access to work sites from state and local roads will be permitted provided the municipality having jurisdiction for the road gives written permission. Holiday periods for this project shall be as follows:

SCHEDULE AND SUSPENSION OF WORK*****SYRACUSE DIVISION*****

2025						
HOLIDAY	FROM			TO		
	TIME	DAY	DATE	TIME	DAY	DATE
Dr. Martin Luther King, Jr. Day	Noon	Friday	01/17/2025	8:00 p.m.	Monday	01/20/2025
Presidents' Day	Noon	Friday	02/14/2025	8:00 p.m.	Monday	01/17/2025
Easter	Noon	Thursday	04/17/2025	8:00 p.m.	Monday	04/21/2025
Memorial Day	Noon	Thursday	05/22/2025	Noon	Tuesday	05/27/2025
Canada Day/Independence Day	Noon	Monday	07/01/2025	Noon	Monday	07/07/2025
State Fair/Labor Day	6:00 a.m.	Wednesday	07/20/2025	Noon	Tuesday	09/02/2025
Columbus Day/ Thanksgiving (Canada)	6:00 a.m.	Friday	10/10/2025	Noon	Tuesday	10/14/2025
Thanksgiving	Noon	Tuesday	11/25/2025	Noon	Monday	12/01/2025
Christmas/New Year's Day	Noon	Wednesday	12/24/2025	6:00 a.m.	Friday	01/02/2026

2026						
HOLIDAY	FROM			TO		
	TIME	DAY	DATE	TIME	DAY	DATE
Dr. Martin Luther King, Jr. Day	Noon	Friday	01/16/2026	8:00 p.m.	Monday	01/19/2026
Presidents' Day	Noon	Friday	02/13/2026	8:00 p.m.	Monday	02/16/2026
Easter	Noon	Thursday	04/02/2026	8:00 p.m.	Monday	04/06/2026
Memorial Day	Noon	Thursday	05/21/2026	Noon	Tuesday	05/26/2026
Juneteenth	Noon	Thursday	06/18/2026	Noon	Monday	06/22/2026
Canada Day/Independence Day	Noon	Tuesday	06/30/2026	Noon	Monday	07/06/2026
State Fair/Labor Day	6:00 a.m.	Wednesday	08/26/2026	Noon	Tuesday	09/08/2026
Columbus Day/ Thanksgiving (Canada)	6:00 a.m.	Friday	10/09/2026	Noon	Tuesday	10/13/2026
Thanksgiving	Noon	Tuesday	11/24/2026	Noon	Monday	11/30/2026
Christmas/New Year's Day	Noon	Thursday	12/24/2026	6:00 a.m.	Monday	01/04/2027

2. Proposed lane closure schedules shall be submitted to the Engineer for review and approval at least one week in advance of the earliest closure.
3. The Contractor shall **NOT** be allowed to establish any lane closures during periods of inclement weather, wet or icy pavement, reduced visibility, traffic accident, emergency, or if the lane closure is causing excessive delay to the public. The Authority reserves the right to alter any lane closure and/or direct the Contractor to immediately remove a lane closure during such circumstances. The Authority shall be the sole judge of when conditions warrant these lane closure restrictions, and such restrictions will not entitle the Contractor to file a claim for additional compensation.
4. **SYRACUSE STATE FAIR 2025:** Lane closures will **NOT** be permitted from 7:30 a.m. Wednesday, August 20, 2025, through 6:30 a.m. Tuesday, September 2, 2025.

SCHEDULE AND SUSPENSION OF WORK

5. **WINTER SHUTDOWN.** A winter shutdown shall be in effect from 3:00 p.m. **November 15** to 6:00 a.m. **April 1**. During this period, the Contractor shall **NOT** be permitted to have lane closures. All temporary tape lines shall be removed, temporary concrete barrier shall be set in its winter shutdown location, and all traffic shall be re-established to its pre-construction configuration on permanent alignment. Mobilization for the following construction season may begin prior to **April 1** with permission from the Authority.
6. The Contractor shall submit a Plan of Operations to the Engineer prior to working on any full-depth repair area shown in the contract documents. The Plan of Operations shall list all full-depth repair areas and the estimated duration to complete each location. The Contractor shall also identify any full-depth repair area that may not be completed within the timeframes allowed by the traffic management table(s). For such location(s), the Contractor may request a waiver of restrictions to complete the repair(s). The Authority will review the request and determine whether or not a waiver will be granted. The Authority has the right to divide repair areas into smaller sections in lieu of granting a waiver.
7. The Contractor shall have 45 calendar days to replace the Milled in Audible Roadway Delineators (MIARDs; Formerly referred to as Shoulder Treatment for Accident Reduction (STAR) groove pattern) where more than 1,500 contiguous feet have been removed by other contract work. The Contractor shall also ensure that MIARDs are installed prior to the official shutdown period, regardless of the 45 calendar day requirement or the length removed. Exceptions to this requirement are shoulders protected by temporary traffic control devices installed as part of a work zone traffic control plan developed in the contract documents or areas directly adjacent to detour pavement that will be used in subsequent phase(s) of the project.

The Contractor shall consider these requirements when preparing bids and scheduling/sequencing the work for this contract. Failure to comply with the time frames specified will be considered a substantial deficiency in work zone traffic control and result in the non-payment for the Basic Work Zone Traffic Control Item for each calendar day during which MIARDs (formerly referred to as STARs) remain incomplete. Liquidated Damages will also be assessed at rates shown in Table 108-1 of the NYSDOT Standard Specifications.

8. Work restrictions may be modified if:
 - a. The Contractor has received permission through the Engineer, from the Division Director or designee, to progress construction operations contained entirely behind temporary concrete barrier. There shall be no hauling of materials in or out of the work site during restricted periods, and open lane availability requirements shall not be violated or compromised.
 - b. The Contractor has received permission through the Engineer, from the Division Director or designee, for temporary modification of the lane availability restrictions for performance of specific construction operations for a specific time period.

NOTE: Such requests must be based on current traffic volumes which would permit the requested temporary modification with little probability of causing disruption or delay to the public.

The Contractor shall include full explanation of the benefits to the Public and to the Authority, which would accrue in granting a temporary waiver for performance of the specific operations including calculations for any credit that may be offered. A contingency plan for action to be taken, should an unexpected traffic backup occur, shall accompany this presentation and will be one prime consideration in evaluating the request.

SCHEDULE AND SUSPENSION OF WORK

- c. The Contractor has received written authorization from the Division Director or designee to perform specific construction operations, violating the lane availability restrictions or other work restrictions during a specifically prohibited time period.

NOTE: The Contractor shall submit a written request to the Authority's Division Director, with copy to the Engineer, for permission to perform specific construction operations at specific locations and times, including a detailed explanation of why the work cannot be performed in conformance with the contract. Such requests must be received at the Division Office at least one full week before the date of the requested variance, and at least two full weeks should granting the waiver require making notice to the public regarding potential disruptions and delays.

If written authorization to work is granted by the Authority, the Contractor shall be strictly limited to those operations approved in the authorization. In making application for a waiver, the Contractor agrees that any waiver of restrictions granted by the Authority is exclusively for the Authority's benefit and purposes, and as such is subject to revocation without requirement for advance notice. Also, the disapproval of requests for waiver of contract requirements is not subject to administrative review or appeal under the contract.

C. GENERAL CONDITIONS

The Contract is to be completed on or before the specified completion date. If, for any reason, the Contractor fails to fulfill this obligation and requests an extension of time and the request is granted, the Authority, as a condition for extending the time of completion, shall retain the right to limit the Contractor's hours and/or days of work and/or impose conditions under which the work shall be performed in order that the traffic may not be unduly inconvenienced.

All the required liability and property damage insurance with the limits stated in this Proposal shall be effective and shall be continued in force throughout the life of this Contract including the stated periods of the suspension of the work.

The Contractor shall consider the foregoing requirement when preparing its "Schedule of Operations".

ADDITIONAL INSURED PARTIES

The following is a list of additional insured parties:

- Town of Manchester

NON-REVENUE CONTRACTOR TRAVEL

NYS Thruway has converted to Cashless Tolling, Non-revenue pass plates will no longer be furnished to the Contractor.

Contractors and Consultants must have a properly mounted E-Z Pass transponder and must submit their EZ-Pass information to the Thruway to avoid charges for contract related business on the Thruway. The Project Engineer will provide the form used to record and submit EZ Pass information. Initial information shall be submitted to the Project Engineer prior to the start of work on the project. The initial form and any changes shall be submitted 5 working days prior to intended travel.

The Contractor shall be responsible for any and all tolls charged to contractor owned vehicles with (or without) E-ZPass Transponders not registered with the Authority.

OTHER CONTRACTS

The Contractor will be required to coordinate work with other contractors and NYSTA maintenance forces. The following contracts have been let and may have work in progress during the duration of this contract:

<u>CONTRACT NO.</u>	<u>DESCRIPTION</u>	<u>COMPLETION DATE</u>
N/A		

ENGINEER'S OFFICE AND CONTRACTOR'S FIELD OFFICE

The site shall be approved by the Engineer prior to placing the offices and the area shall be kept in a neat, clean condition at all times. The area shall not be used as a staging, storage, equipment or employee parking area.

U-TURNS/CROSSOVERS

The Contractor will not be permitted to make U-turns or crossovers at any location on the Thruway system. All vehicles must exit the Thruway system and re-enter for all direction changes. All applicable traffic laws must be followed.

SPOIL AREA

There is no identified spoil area within the Thruway Authority's right-of-way for this contract. Therefore, the Contractor shall remove all surplus material and waste from Thruway Authority (Authority) property. The Contractor shall bid accordingly for this condition.

The Contractor shall provide the Authority a copy of all easements and/or access agreement letters received from landowner(s) of off-site disposal area(s) prior to disposal of any material. The easements and/or access agreement letters must include a statement by the Contractor and the landowner that the disposal of the material is in compliance with all applicable federal, state and local laws and regulations.

Should a mutually approved spoil use area within the Authority's right-of-way be identified for Contractor use after the project letting, a credit in the amount of 50% of the unclassified excavation unit bid price will be deducted for each cubic yard spoiled within the Authority right-of-way. If the contract does not contain an unclassified excavation item, the credit will be determined using either 50% of the item generating the spoil or 50% of the Division/Regional weighted average bid price for unclassified excavation, whichever is less. This credit may be waived, either wholly or in part, by the Division Director in writing if it is determined that permitting spoil on Authority right-of-way is in the best interest of the Authority (ie: slope flattening resulting in elimination of guide rail).

OVERHEAD GANTRY SIGNING

Signs shall be installed within the project limits when any component of equipment will be operating above 14'-6" in elevation and within 100 linear feet of an overhead gantry. Overhead gantries may have electric powered wires and special equipment, therefore, vehicle and equipment operations must be planned and proposed equipment safety procedures included in a Project Safety and Health Plan.

As mentioned in the Thruway Addendum to the Standard Specifications (TA), specifically in **Section 107-05 SAFETY AND HEALTH REQUIREMENTS, O. Equipment Safety Procedures. 6. Work Operations. d.** Dump truck boxes may be raised only under the control of a spotter, unless the vehicle is in an area clearly marked to be free of overhead wires and safe for dumping.

Refer to Thruway Standard Sheet **TA 619-27** for additional information and signing requirements.

OVERHEAD GANTRY TRAFFIC SHIFT RESTRICTIONS

The Contractor shall not shift traffic at any toll gantry such that vehicles are traveling between lanes or between lanes/shoulders when passing under the gantry centerline (treadle). Traffic shifts, for purposes of staging work, shall be done prior to or after the gantries, such that vehicles are traveling within a complete lane or shoulder when passing under the gantry centerline (treadle). All work zone traffic control shall be provided in accordance with the 619 Standard Specifications and the Thruway Addendum to the 619 Standard Specifications, the National Manual on Uniform Traffic Control Devices and NYS Supplement, any provisions contained within the contract documents, and as ordered by the Engineer.

OVERHEAD GANTRY PARKING RESTRICTIONS

The Contractor shall not park any vehicle or construction equipment directly beneath overhead gantries, within a complete lane or between a lane/shoulder, unless it is required to perform project specific related work, as directed by the Engineer in Charge and after coordination with the Authority's Intelligent Transportation System Management unit.

SUPPLEMENTAL INFORMATION FOR BIDDERS

Supplemental information is available to bidders. As indicated below, information is either available on the Thruway Authority's website with the contract plans and proposal or available in electronic format from the Thruway Authority upon request prior to or after the letting date.

The bidder's signature on this proposal certifies that they have made themselves aware of the availability of the information indicated below prior to the letting date.

INFORMATION	NOT AVAILABLE	AVAILABLE ON THRUWAY AUTHORITY WEBSITE
Engineer Estimate Quantity Workups	X	
Utility Estimate Sheets with Names of Utility Officials	X	
Earthwork Cross Section Sheets	X	
Earthwork Sheets	X	
Drainage Estimate Sheets	X	
Sign Face Layouts	X	
Subsurface Exploration Logs		X
Rock Core Evaluation Logs and Photographs	X	
Compression Test Data from Rock Samples	X	
Pavement Core Logs and Photographs	X	
Logs Showing Laboratory Description of Soil Samples	X	
Laboratory Test Data from Soil Samples	X	
Rock Outcrop Maps	X	
Record Plans	X	
Applicable Asbestos Blanket Variances	X	
Storm Water Pollution Prevention Plan	X	
Shop Drawings	X	
CADD Files of Contract Plans (Unofficial - Not signed or stamped)	X	
Special Reports or Other Information		X

Hard copies of the supplemental information indicated above are not available. Contractors shall be responsible for their own hard copies of this information at no additional cost to the Authority.

**REVISIONS TO
NYSDOT
STANDARD
SPECIFICATIONS**

NEW YORK STATE THRUWAY AUTHORITY ADDENDUM TO THE STANDARD SPECIFICATIONS

The Standard Specifications published by the New York State Department of Transportation shall form a part of the agreement. The dated edition that applies to this contract is provided on the front cover of the Proposal. All work contemplated under this contract is to be covered by, and be in conformance with, the Standard Specifications as modified by The New York State Thruway Authority Addendum (TA) to the Standard Specification Books.

The officially adopted Thruway Authority Addendum (TA) to the NYSDOT Standard Specification Books is available on the Thruway Authority website at:

<http://www.thruway.ny.gov/business/addendum/index.html>

The most recent version of the TA, prior to the project Letting Date, shall apply to this agreement.

All special notes bound in this proposal shall be incorporated. If a conflict exists between the special specifications and/or provisions set forth in this proposal and the specifications and/or provisions set forth in the New York State Department of Transportation's Standard Specifications, those in the Proposal shall govern.

SPECIAL SPECIFICATIONS

SPECIAL NOTE
SPECIAL SPECIFICATION PAY ITEM NUMBERS

The Contractor's attention is directed to the special specification pay item formats used in this contract. Special specification pay items may be presented in two (2) different formats:

Format 1: Pay items for a special specification will have three (3) digits to the left of the decimal point and up to eight (8) digits to the right of the decimal. Spaces may appear in the third to sixth places after the decimal. The 7th and 8th digits to the right of the decimal will represent the origin of the specification.

Format 2: Pay items for a special specification will have three (3) digits to the left of the decimal point and up to eight (8) digits to the right of the decimal. Dashes may appear in the third to sixth places after the decimal. The 7th and 8th digits to the right of the decimal will represent the origin of the specification.

Where items in this contract appear in multiple formats, the formats shall be equated to each other as illustrated below:

FORMAT 1

XXX.XX XX
 XXX.XXXX XX
 XXX.XXXXXXXX

FORMAT 2

XXX.XX-----XX
 XXX.XXXX---XX
 XXX.XXXXXXXX

ITEM 627.0001 25**GENERAL REQUIREMENTS****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment, and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.
- 1.02 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, of the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various items conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0001 25**GENERAL REQUIREMENTS****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

- A. Section 000110 TABLE OF CONTENTS
- B. Section 003126 EXISTING HAZARDOUS MATERIAL INFORMATION
- C. Section 003132 GEOTECHNICAL DATA
- D. Section 014533 CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

1.02 This item shall include, but not be limited to, the following:

- A. Information on hazardous materials such as ACM, as well as a reference to supplemental information. This information is listed in Section 003126 - HAZARDOUS MATERIAL INFORMATION.
- B. Description of the geotechnical information pertinent to the project will be included in Section 003132 - GEOTECHNICAL DATA

1.03 Items specifically not paid for under this item shall include, but not be limited to, the following:

- A. Not Used

SECTION 000110 - TABLE OF CONTENTS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

000110	TABLE OF CONTENTS
003126	EXISTING HAZARDOUS MATERIALS INFORMATION
003132	GEOTECHNICAL DATA

DIVISION 01 – GENERAL REQUIREMENTS

014533	CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

DIVISION 02 - EXISTING CONDITIONS

024119	SELECTIVE STRUCTURE DEMOLITION
028213	ASBESTOS ABATEMENT

DIVISION 03 – CONCRETE

030130	CONCRETE DECK REPAIRS
031119	PERMANENT FORMS – ICF
033000	CAST-IN-PLACE CONCRETE

DIVISION 04 – MASONRY

042000	UNIT MASONRY

DIVISION 05 – METALS

052100	STEEL JOIST FRAMING
053100	STEEL DECKING
055000	METAL FABRICATIONS

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

061053	MISCELLANEOUS ROUGH CARPENTRY
064023	INTERIOR ARCHITECTURAL WOODWORK

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

070150.19	PREPARATION FOR REROOFING
072100	THERMAL INSULATION
074213	METAL WALL PANELS
075323	EPDM ROOFING
076200	SHEET METAL FLASHING AND TRIM
077100	ROOF SPECIALTIES
079200	JOINT SEALANTS

DIVISION 08 – OPENINGS

081113	HOLLOW METAL DOORS AND FRAMES
085113	ALUMINUM WINDOWS
087100	DOOR HARDWARE

DIVISION 09 – FINISHES

092216	NON-STRUCTURAL METAL FRAMING
092900	GYPSUM BOARD
093000	TILING
095113	ACOUSTICAL PANEL CEILINGS
096513	RESILIENT BASE AND ACCESSORIES
096519	RESILIENT TILE FLOORING
099113	EXTERIOR PAINTING
099123	INTERIOR PAINTING
099600	HIGH-PERFORMANCE COATINGS

DIVISION 10 – SPECIALTIES

101400	SIGNAGE
102113.19	PLASTIC TOILET COMPARTMENTS
102800	TOILET, BATH, AND LAUNDRY ACCESSORIES
104413	FIRE PROTECTION CABINETS

DIVISION 12 – FURNISHINGS

123530	RESIDENTIAL CASEWORK
123661.16	SOLID SURFACING COUNTERTOPS

DIVISION 22 – PLUMBING

220500	COMMON WORK RESULTS FOR PLUMBING
220513	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
220519	METERS AND GAUGES FOR PLUMBING PIPING
220523	GENERAL DUTY VALVES FOR PLUMBING PIPING
220529	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
220553	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
220700	PLUMBING INSULATION
221116	DOMESTIC WATER PIPING
221119	DOMESTIC WATER PIPING SPECIALTIES
221123	DOMESTIC WATER PUMPS
221124	FACILITY NATURAL GAS PIPING
221316	SANITARY WASTE PIPING AND VENT PIPING
221319	SANITARY WASTE PIPING SPECIALTIES
221423	STORM DRAINAGE PIPING SPECIALTIES
223400	FUEL-FIRED DOMESTIC WATER HEATERS
224000	PLUMBING FIXTURES

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

230500	COMMON WORK RESULTS FOR HVAC
230513	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
230529	HANGERS AND SUPPORTS FOR HVAC PIPING AND
230548.13	EQUIPMENT VIBRATION CONTROLS FOR HVAC
230593	TESTING, ADJUSTING AND BALANCING
230713	DUCT INSULATION
233113	METAL DUCTS
233300	AIR DUCT ACCESSORIES
233713.23	DIFFUSERS AND GRILLES
237416.11	PACKAGED, SMALL CAPACITY, HVAC UNIT WITH GAS HEAT

SECTION 26 – ELECTRICAL

260100	GENERAL ELECTRICAL REQUIREMENTS
260519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
262416	PANELBOARDS
262726	WIRING DEVICES
262816	ENCLOSED SWITCHES
265100	INTERIOR LIGHTING

DIVISION 27 – COMMUNICATIONS

270500	COMMON WORK RESULTS FOR COMMUNICATIONS
271500	COMMUNICATION CABLING

DIVISION 31 – EARTHWORK

311000	SITE CLEARING
312000	EARTH MOVING
312319	DEWATERING
315000	EXCAVATION SUPPORT AND PROTECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

321216	ASPHALT PAVING
321723	PAVEMENT MARKINGS
323113	FENCES AND GATES
329200	TURF AND GRASSES

END OF SECTION 000110

Manchester Addition and Renovations to Maintenance Section, MP 340.15

SECTION 003126 - EXISTING HAZARDOUS MATERIAL INFORMATION

1.1 EXISTING HAZARDOUS MATERIAL INFORMATION

- A. This Section with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Contractors' convenience and are intended to supplement rather than serve in lieu of Contractors' own investigations and are not a warranty of existing conditions.
- B. An existing asbestos containing materials report for Project prepared by CORE Environmental Consultant, Inc., titled "Inspection for Asbestos-Containing Materials (Scope Asbestos Report) performed at Manchester Maintenance Section", dated August 22, 2019, and "Limited Pre-Demolition Asbestos Inspection" report prepared by AZAR Design Co, dated January 7, 2025 will be provided as supplemental information.

END OF SECTION 003126

SECTION 003132 – GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

- A. This Section with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
- B. A geotechnical investigation report for this Project, prepared by WMA Engineering, DPC, dba Empire Geotechnical Engineering Services, dated September 6, 2019 will be provided as supplemental information.

END OF SECTION 003132

SECTION 014533
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.
- D. Manufacturers' field services.
- E. Fabricators' field services.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 003119 - Existing Condition Information: Soil investigation data.
- C. Document 007100 - General Conditions: Inspections and approvals required by public authorities.
- D. Section 012100 - Allowances: Allowance for payment of testing services.
- E. Section 013300 Submittal Procedures: Submittal procedures.
- F. Section 014000 - Quality Requirements.
- G. Section 014200 - Reference Standards.
- H. Section 016000 - Product Requirements: Requirements for material and product quality.

1.03 ABBREVIATIONS AND ACRONYMS

- A. AHJ: Authority having jurisdiction.
- B. IAS: International Accreditation Service, Inc.
- C. NIST: National Institute of Standards and Technology.

1.04 DEFINITIONS

- A. Code or Building Code: ICC (IBC)-2018, Edition of the International Building Code and specifically, Chapter 17 - Special Inspections and Tests.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. Special Inspection:
 - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.
 - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.05 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).

Manchester Addition and Renovations to Maintenance Section, MP 340.15

- B. AISC 341 - Seismic Provisions for Structural Steel Buildings; 2022.
- C. AISC 360 - Specification for Structural Steel Buildings; 2022, with Errata (2023).
- 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 A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- F. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2022a.
- G. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2024.
- H. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2017.
- I. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.
- J. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2023.
- K. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.
- L. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 2019 (Reapproved 2023).
- M. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2019 (Reapproved 2023).
- N. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.
- O. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.
- P. ASTM E2570/E2570M - Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used Under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage; 2007 (Reapproved 2019).
- Q. AWCI 117 - Technical Manual 12-B; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; an Annotated Guide; 2014.
- R. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- S. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).
- T. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars; 2018, with Amendment (2020).
- U. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2021.
- V. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291; 2019.
- W. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- X. ICC (IBC)-2009 - International Building Code; 2009.
- Y. ICC (IBC)-2012 - International Building Code; 2012.
- Z. ICC (IBC)-2015 - International Building Code; 2015.
- AA. ICC (IBC)-2018 - International Building Code; 2018.
- BB. SDI (QA/QC) - Standard for Quality Control and Quality Assurance for Installation of Steel Deck; 2017.
- CC. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.

DD. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.06 SUBMITTALS

- A. See Section 013300 Submittal Procedures, for submittal procedures.
- B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
 - 4. Submit documentation that Special Inspection Agency is accredited by IAS according to IAS AC291.
- C. Testing Agency Qualifications: Prior to the start of work, the Testing Agency is required to:
 - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Testing Agency is acceptable to AHJ.
 - 4. Submit documentation that Testing Agency is accredited by IAS according to IAS AC89.
- D. Smoke Control Testing Agency Qualifications: Prior to the start of work, the Testing Agency is required to:
 - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit documentary evidence that agency has appropriate credentials and documented experience in fire protection engineering, mechanical engineering and HVAC air balancing.
 - 3. Submit certification that Testing Agency is acceptable to AHJ.
 - 4. Submit documentation that Testing Agency is accredited by IAS according to IAS AC89.
- E. Manufacturer's Qualification Statement: Manufacturer is required to submit documentation of manufacturing capability and quality control procedures. Include documentation of AHJ approval.
- F. Fabricator's Qualification Statement: Fabricator is required to submit documentation of fabrication facilities and methods as well as quality control procedures. Include documentation of AHJ approval.
- G. Special Inspection Reports: After each special inspection, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to the AHJ.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of special inspection.
 - h. Date of special inspection.
 - i. Results of special inspection.
 - j. Compliance with Contract Documents.

2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.
- H. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to AHJ.
 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of fabricated item and specification section.
 - f. Location in the Project.
 - g. Results of special inspection.
 - h. Verification of fabrication and quality control procedures.
 - i. Compliance with Contract Documents.
 - j. Compliance with referenced standard(s).
- I. Test Reports: After each test or inspection, promptly submit at least two copies of report; one to Architect and one to AHJ.
 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test or inspection.
 - h. Date of test or inspection.
 - i. Results of test or inspection.
 - j. Compliance with Contract Documents.
- J. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.
- K. Manufacturer's Field Reports: Submit reports to Architect and AHJ.
 1. Submit report in duplicate within 30 days of observation to Architect for information.
 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.
- L. Fabricator's Field Reports: Submit reports to Architect and AHJ.
 1. Submit report in duplicate within 30 days of observation to Architect for information.
 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.

1.07 SPECIAL INSPECTION AGENCY

- A. Owner or Architect will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.

- B. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.
- C. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.08 TESTING AND INSPECTION AGENCIES

- A. Owner or Architect may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.09 QUALITY ASSURANCE

- A. Special Inspection Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 2. Accredited by IAS according to IAS AC291.
- B. Testing Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 2. Accredited by IAS according to IAS AC89.
- C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
 - 1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

- A. Structural Steel: Comply with quality assurance inspection requirements of ICC (IBC)-2018.
- B. Cold-Formed Steel Deck: Comply with quality assurance inspection requirements of SDI (QA/QC).
- C. Open-Web Joists and Joist Girders: Comply with requirements of ICC (IBC), Table 1705.2.3.
 - 1. End Connections - Welding or Bolted: Comply with requirements of SJI 100; periodic.
 - 2. Bridging - Horizontal or Diagonal:
 - a. Standard Bridging: Comply with requirements of SJI 100; periodic.
 - b. Bridging That Differs From the SJI Specifications: Periodic inspection.
- D. Cold-Formed Steel Trusses Spanning 60 feet (18.3 m) or Greater: Special Inspector is required to verify that the temporary installation restraint/bracing and the permanent individual

truss member restraint/bracing are installed in accordance with the approved truss submittal package.

- E. High-Strength Bolt, Nut and Washer Material:
 - 1. Verify identification markings comply with ASTM standards specified in the approved contract and to AISC 360, Section A3.3; periodic.
 - 2. Submit manufacturer's certificates of compliance; periodic.
- F. High-Strength Bolting Installation: Verify items listed below comply with AISC 360, Section M2.5.
 - 1. Snug tight joints; periodic.
 - 2. Pretensioned and slip-critical joints with matchmarking, twist-off bolt or direct tension indicator method of installation; periodic.
 - 3. Pretensioned and slip-critical joints without matchmarking or calibrated wrench method of installation; continuous.
- G. Structural Steel and Cold Formed Steel Deck Material:
 - 1. Structural Steel: Verify identification markings comply with AISC 360, Section M3.5; periodic.
 - 2. Other Steel: Verify identification markings comply with ASTM standards specified in the approved Contract Documents; periodic.
 - 3. Submit manufacturer's certificates of compliance and test reports; periodic.
- H. Weld Filler Material:
 - 1. Verify identification markings comply with AWS standards specified in the approved Contract Documents and to AISC 360, Section A3.5; periodic.
 - 2. Submit manufacturer's certificates of compliance; periodic.
- I. Welding:
 - 1. Structural Steel and Cold Formed Steel Deck:
 - a. Complete and Partial Joint Penetration Groove Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - b. Multipass Fillet Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - c. Single Pass Fillet Welds Less than 5/16 inch (7.94 mm) Wide: Verify compliance with AWS D1.1/D1.1M; periodic.
 - d. Plug and Slot Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - e. Single Pass Fillet Welds 5/16 inch (7.94 mm) or Greater: Verify compliance with AWS D1.1/D1.1M; continuous.
 - f. Floor and Roof Deck Welds: Verify compliance with AWS D1.3/D1.3M; continuous.
- J. Steel Frame Joint Details: Verify compliance with approved Contract Documents.
 - 1. Details, bracing and stiffening; periodic.
 - 2. Member locations; periodic.
 - 3. Application of joint details at each connection; periodic.
- K. Cold-formed steel trusses spanning 60 feet or more; periodic.

3.03 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

- A. Reinforcement, Including Prestressing Tendons, and Verification of Placement: Verify compliance with ACI 318, Chapters 20, 25.2, 25.3, 26.6.1-26.6.3; periodic.
- B. Anchors Cast in Concrete: Verify compliance with ACI 318; periodic.
- C. Anchors Post-Installed in Hardened Concrete: Verify compliance with ACI 318.
 - 1. Adhesive Anchors: Verify horizontally or upwardly-inclined orientation installations resisting sustained tension loads - Section 17.8.2.4; continuous.
 - 2. Other Mechanical and Adhesive Anchors: Verify as per Chapter 17.8.2; periodic.
- D. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI 318, Chapter 19, 16.4.3, 26.4.4; periodic.

- E. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M and ACI 318, Chapter 26.5, 26.12, and record the following, continuous:
 - 1. Slump.
 - 2. Air content.
 - 3. Temperature of concrete.
- F. Concrete and Shotcrete Placement: Verify application techniques comply with approved Contract Documents and ACI 318, Chapter 26.5; continuous.
- G. Specified Curing Temperature and Techniques: Verify compliance with ACI 318, Chapter 26.5.3 through 26.5.5; periodic.
- H. Precast Concrete Members: Verify erection techniques and placement comply with approved Contract Documents and ACI 318, Chapter 26.9; periodic.
- I. Formwork Shape, Location and Dimensions: Verify compliance with approved Contract Documents and ACI 318, Chapter 26.11.1.2(b); periodic.
- J. Materials: If the Contractor cannot provide sufficient data or documentary evidence that concrete materials comply with the quality standards of ACI 318, the AHJ will require testing of materials in accordance with the appropriate standards and criteria in ACI 318, Chapters 19 and 20.

3.04 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

- A. Masonry Structures Subject to Special Inspection:
 - 1. Masonry construction when required by the quality assurance program of TMS 402/602.
 - 2. Engineered masonry in structures classified as "Standard Hazard" (Category II.)
 - a. Perform inspections in accordance with Level B Quality Assurance.
- B. Verify each item below complies with approved Contract Documents and the applicable articles of TMS 402/602.
 - 1. Inspections and Approvals:
 - a. Verify compliance with the required inspection provisions of the approved Contract Documents; periodic.
 - b. Verify approval of submittals required by Contract Documents; periodic.
 - 2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction unless specifically exempted by code; periodic.
 - 3. Slump Flow and Visual Stability Index (VSI): Verify compliance as self consolidating grout arrives on site; continuous.
 - 4. Joints and Accessories: When masonry construction begins, verify:
 - a. Proportions of site prepared mortar; periodic.
 - b. Construction of mortar joints; periodic.
 - c. Location of reinforcement, connectors, prestressing tendons, anchorages, etc; periodic.
 - d. Prestressing technique; periodic.
 - e. Grade and size of prestressing tendons and anchorages; periodic.
 - 5. Structural Elements, Joints, Anchors, Protection: During masonry construction, verify:
 - a. Size and location of structural elements; periodic.
 - b. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; periodic.
 - c. Size, grade and type of reinforcement, anchor bolts and prestressing tendons and anchorages; periodic.
 - d. Welding of reinforcing bars; continuous.
 - e. Preparation, construction and protection of masonry against hot weather above 90 degrees F (50 degrees C) and cold weather below 40 degrees F (22 degrees C); periodic.

- f. Application and measurement of prestressing force; continuous.
- 6. Grouting Preparation: Prior to grouting, verify:
 - a. Grout space is clean; periodic.
 - b. Correct placement of reinforcing, connectors, prestressing tendons and anchorages; periodic.
 - c. Correctly proportioned site prepared grouts and prestressing grout for bonded tendons; periodic.
 - d. Correctly constructed mortar joints; periodic.
- 7. Preparation of Grout Specimens, Mortar Specimens and Prisms: Observe preparation of specimens; periodic.
- C. Engineered Masonry in Buildings Designated as "Essential Facilities": Verify compliance of each item below with approved Contract Documents and the applicable articles of TMS 402/602.
 - 1. Inspections and Approvals:
 - a. Perform inspections in accordance with Level C Quality Assurance.
 - b. Verify compliance with the required inspection provisions of the approved Contract Documents; periodic.
 - c. Verify approval of submittals required by Contract Documents; periodic.
 - 2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction and upon completion of each 5,000 square feet (464.5 sq m) increment of masonry erected during construction; periodic.
 - 3. Preblended Mortar and Grout: Verify proportions of materials upon delivery to site; periodic.
 - 4. Slump Flow and Visual Stability Index (VSI): Verify compliance as self consolidating grout arrives on site; continuous.
 - 5. Engineered Elements, Joints, Anchors, Grouting, Protection: Verify compliance of each item below with approved Contract Documents and referenced standards.
 - a. Proportions of site prepared mortar; periodic.
 - b. Placement of masonry units and construction of mortar joints; periodic.
 - c. Placement of reinforcement, connectors, prestressing tendons, anchorages, etc.; periodic.
 - d. Grout space prior to grouting; continuous.
 - e. Placement of grout; continuous.
 - f. Placement of prestressing grout; continuous.
 - g. Size and location of structural elements; periodic.
 - h. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; continuous.
 - i. Size, grade and type of reinforcement, anchor bolts and prestressing tendons and anchorages; periodic.
 - j. Welding of reinforcing bars; continuous.
 - k. Preparation, construction and protection of masonry against hot weather above 90 degrees F (50 degrees C) and cold weather below 40 degrees F (22 degrees C); periodic.
 - l. Application and measurement of prestressing force; continuous.
 - 6. Preparation of Grout Specimens, Mortar Specimens and Prisms: Observe preparation of specimens; continuous.

3.05 SPECIAL INSPECTIONS FOR PREFABRICATED AND SITE-BUILT WOOD CONSTRUCTION

- A. High Load Diaphragms: Verify compliance of each item below with approved Contract Documents.
 - 1. Grade and thickness of sheathing.
 - 2. Nominal size of framing members at adjacent panel edges.
 - 3. Nail or staple diameter and length.

4. Number of fastener lines.
5. Fastener spacing at lines and at edges.
- B. Metal Plate Connected Wood Trusses with Clear Span of 60 feet (18.3 m) or More: Verify compliance of each item below with approved Contract Documents in general and with approved truss submittal package in particular.
 1. Temporary restraint and bracing.
 2. Permanent individual truss member restraint and bracing.

3.06 SPECIAL INSPECTIONS FOR SOILS

- A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
 1. Design bearing capacity of material below shallow foundations; periodic.
 2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
 3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
 4. Subgrade, prior to placement of compacted fill verify proper preparation; periodic.
- B. Testing: Classify and test excavated material; periodic.

3.07 STRUCTURAL OBSERVATIONS FOR STRUCTURES

- A. Provide Observations: For structure where one or more of the following conditions exist:
 1. The structure is classified as Risk Category IV.
 2. The structure is a high-rise building.
 3. Such observation is required by the registered design professional responsible for the structural design.
 4. Such observation is specifically required by AHJ.

3.08 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 1. Verify samples submitted by Contractor comply with the referenced standards and the approved Contract Documents.
 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 3. Perform specified sampling and testing of products in accordance with specified reference standards.
 4. Ascertain compliance of materials and products with requirements of Contract Documents.
 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 6. Perform additional tests and inspections required by Architect.
 7. Attend preconstruction meetings and progress meetings.
 8. Submit reports of all tests or inspections specified.
- B. Limits on Special Inspection Agency Authority:
 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency may not approve or accept any portion of the work.
 3. Agency may not assume any duties of Contractor.
 4. Agency has no authority to stop the work.
- C. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

- D. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.09 TESTING AGENCY DUTIES AND RESPONSIBILITIES

- A. Testing Agency Duties:
 - 1. Test samples submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Attend preconstruction meetings and progress meetings.
 - 8. Submit reports of all tests or inspections specified.
- B. Limits on Testing or Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the work.
- C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.
- D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

3.10 CONTRACTOR DUTIES AND RESPONSIBILITIES

- A. Contractor Responsibilities, General:
 - 1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
 - 2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to work to be tested or inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
 - c. To facilitate tests or inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
 - 5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 6. Retain special inspection records.
- B. Contractor Responsibilities, Seismic Force-Resisting System, Designated Seismic System, and Seismic Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

- C. Contractor Responsibilities, Wind Force-Resisting System and Wind Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

3.11 MANUFACTURER'S AND FABRICATOR'S FIELD SERVICES

- A. When specified in individual specification sections, require material suppliers, assembly fabricators, or product manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, to test, adjust, and balance equipment and _____ as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
 - 1. Observer subject to approval of Architect.
 - 2. Observer subject to approval of Owner.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.12 STATEMENT OF SPECIAL INSPECTIONS

- A. Refer to attached form, "Statement of Special Inspections", at the end of this section.
- B. Refer to attached, "Schedule of Special Inspections", at the end of this section.

3.13 SPECIAL INSPECTION REPORTS

- A. Report Requirement: Special Inspectors shall keep records of inspections. The special inspector shall furnish inspection reports to the code enforcement official, and to the registered design professional in responsible charge.
 - 1. Reports shall indicate that work inspected was done in conformance to approved construction documents.
 - 2. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the code enforcement official and to the registered design professional in responsible charge prior to the completion of that phase of the work.
- B. Periodic Report: On the first day of each month, the special inspector shall furnish to the Architect five copies of the combined progress reports of the special inspector's observations. These progress reports shall list all special inspections of construction or reviews of testing performed during that month, note all uncorrected deficiencies, and describe the corrections made both to these deficiencies and to previously reported deficiencies.
 - 1. Each monthly report shall be signed by all special inspectors who performed special inspections of construction or reviewed testing during that month, regardless of whether they reported any deficiencies.
 - 2. Each monthly report shall be signed by the Contractor.
- C. Final Report: At completion of construction, each special inspector shall prepare and sign a final report attesting that all work they inspected and all testing and test reports they reviewed were completed in accordance with the approved construction documents and that deficiencies identified were satisfactorily corrected.
 - 1. The Special Inspector shall submit a combined final report containing the signed final reports.
 - 2. The Contractors shall sign the combined final report attesting that all final reports of special inspectors that performed work to comply with these construction documents are contained therein, and that the Contractor has reviewed and approved all of the individual inspector's final reports.

3. Refer to attached form, "Special Inspections Report", attached at the end of this section.

STATEMENT OF SPECIAL INSPECTIONS

Name of Project:	
Address or Legal Description:	
Owner's Name:	
AUTHORITY HAVING JURISDICTION:	
Signed:	
I _____, as the structural engineer of record, certify that I have prepared the following special inspections program as required by the XXXX Building Code for the construction project located at the site listed above.	
Printed Name:	
	Seal
	Signature:
	Date:
List of work requiring special inspections: See following schedule.	

SPECIAL INSPECTIONS REPORTReport Type: ☐ Continuous ☐ Periodic ☐ Final

Work/Material Inspected:

Project Name:

Address or Legal Description:

Owner's Name:

Phone:

email:

Approved Inspection Agency:

Address:

Phone:

email:

Authority Having Jurisdiction:

Address:

Phone:

email:

Registered Design Professional of Record:

Address:

Phone:

email:

Statement of Conformance:

Discrepancies:

☐ None

Contractor review:

Contractor signature:

Contractor correction:

Outstanding Discrepancies:

☐ None

Authority Having Jurisdiction review:

Registered Design Professional review:

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1704.2.5 INSPECTION OF FABRICATORS				
Verify fabrication / quality control procedures	In-plant review		Y	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.1.1 SPECIAL CASES				
1. Work that is unusual in its nature, such as, but not limited to:				
A. Construction materials and systems that are alternatives to materials and systems prescribed by the Building Code	Submittal review, shop ⁽³⁾ and / or field inspection		Y	Periodic
B. Unusual design applications of materials described in the Building Code	Submittal review, shop ⁽³⁾ and / or field inspection		Y	Periodic
C. Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contained in the Building Code or in standards referenced by the Building Code	Submittal review, shop ⁽³⁾ and / or field inspection		Y	Periodic
2. Inspection of anchors post-installed in solid grouted masonry per research reports including verification of:				
A. Anchor type and dimensions	Field inspection		Y	Periodic
B. Hole dimensions and cleaning procedures	Field inspection		Y	Periodic
C. Anchor spacing and edge distances	Field inspection		Y	Periodic
D. Masonry unit, grout, masonry compressive strength	Field inspection		Y	Periodic
E. Anchor embedment and tightening torque	Field inspection		Y	Periodic
3. Aggregate piers				
A. Prior to construction:				
a. Review of aggregate pier designer's use of soil parameters as presented in the project soils report	Field inspection		N	Periodic
B. During construction:				

a. Verification of aggregate properties	Field inspection		N	Periodic
b. Type and number of lifts of aggregate	Field inspection		N	Periodic
c. Verify compliance of with design results of qualitative tests on production aggregate pier elements such as modulus load testing, uplift pull-out testing, bottom stabilization tests and dynamic cone penetration tests	Field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.2 STEEL CONSTRUCTION				
1. Fabricator and erector documents	Submittal review	AISC 360, Section N3.2	Y	Each submittal
2. Material verification of structural steel	Shop ⁽³⁾ and field inspection		Y	Periodic
3. Structural steel welding:				
A. Inspection tasks prior to welding:				
Observe, or perform for each welded joint or member in accordance with QA tasks	Shop ⁽³⁾ and field inspection	AISC 360, Table N5.4-1	Y	Observe or Perform as noted ⁽⁴⁾
B. Inspection tasks during welding:				
Observe, or perform for each welded joint or member in accordance with QA tasks	Shop ⁽³⁾ and field inspection	AISC 360, Table N5.4-2	Y	Observe ⁽⁴⁾
C. Inspection tasks after welding:				
Observe, or perform for each welded joint or member in accordance with QA tasks	Shop ⁽³⁾ and field inspection	AISC 360, Table N5.4-3	Y	Observe or Perform as noted ⁽⁴⁾
D. Nondestructive testing (NDT) of welded joints:				
a) Complete penetration groove welds 5/16" or greater in risk category III or IV	Shop ⁽³⁾ or field ultrasonic testing - 100%		Y	Periodic
b) Complete penetration groove welds 5/16" or greater in risk category II	Shop ⁽³⁾ or field ultrasonic testing - 10% of welds minimum		Y	Periodic
c) Welded joints subject to fatigue when required	Shop ⁽³⁾ or field radiographic or Ultrasonic testing	AISC 360, Appendix 3, Table A3.1	Y	Periodic

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d) Fabricator's NDT reports when fabricator performs NDT	Verify reports		Y	Periodic
4. Structural steel bolting:	Shop ⁽³⁾ and field inspection			
a. Inspection tasks Prior to Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks)		AISC 360, Table N5.6-1	Y	Observe or Perform as noted ⁽⁴⁾
b. Inspection tasks During Bolting in accordance with QA tasks		AISC 360, Table N5.6-2	Y	Observe ⁽⁴⁾
1) Pre-tensioned and slip-critical joints:				
a) Turn-of-nut with matching markings			Y	Periodic
b) Direct tension indicator			Y	Periodic
c) Twist-off type tension control bolt			Y	Periodic
d) Turn-of-nut without matching markings			Y	Continuous
e) Calibrated wrench			Y	Continuous
2) Snug-tight joints			Y	Periodic
Inspection tasks After Bolting (Perform tasks for each bolted connection in accordance with QA tasks)		AISC 360, Table N5.6-3	Y	Perform ⁽⁴⁾
5. Visual inspection of exposed cut surfaces of galvanized structural steel main members and exposed corners of the rectangular HSS for cracks subsequent to galvanizing	Shop ⁽³⁾ or field inspection		Y	Periodic
6. Embedments (Verify diameter, grade, type, length, embedment. See 1705.3 for anchors)	Field inspection		Y	Periodic
7. Verify member locations, braces, stiffeners, and application of joint details at each connection comply with construction documents	Field inspection		Y	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.2.2 COLD FORMED STEEL DECK				
1. Manufacturer documents (Verify reports and certificates with Paragraphs 2.1 and 2.2 for compliance with construction documents)		SDI QA/QC Section 2	Y	

2. Material verification of steel deck, mechanical fasteners and welding materials	Shop ⁽³⁾ and field inspection		Y	Periodic
3. Cold-formed steel deck placement:	Shop ⁽³⁾ and field inspection			
a. Inspection tasks Prior to Deck Placement (Perform the QA tasks)		SDI QA/QC, Appendix 1, Table 1.1	Y	Perform ⁽⁴⁾
b. Inspection tasks After Deck Placement (Perform the QA tasks)		SDI QA/QC, Appendix 1, Table 1.2	Y	Perform ⁽⁴⁾
4. Cold-formed steel deck welding:	Shop ⁽³⁾ and field inspection			
a. Inspection tasks Prior to Welding (Observe the QA tasks)		SDI QA/QC, Appendix 1, Table 1.3	Y	Observe ⁽⁴⁾
b. Inspection tasks During Welding (Observe the QA tasks)		SDI QA/QC, Appendix 1, Table 1.4	Y	Observe ⁽⁴⁾
c. Inspection tasks After Welding (Perform the QA tasks)		SDI QA/QC, Appendix 1, Table 1.5	Y	Perform ⁽⁴⁾
5. Cold-formed steel deck mechanical fastening:	Shop ⁽³⁾ and field inspection			
a. Inspection tasks Prior to Mechanical Fastening (Observe the QA tasks)		SDI QA/QC, Appendix 1, Table 1.6	Y	Observe ⁽⁴⁾
b. Inspection tasks During Mechanical Fastening (Observe the QA tasks)		SDI QA/QC, Appendix 1, Table 1.7	Y	Observe ⁽⁴⁾
c. Inspection tasks After Mechanical Fastening (Perform the QA tasks)		SDI QA/QC, Appendix 1, Table 1.8	Y	Perform ⁽⁴⁾

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.2.3 OPEN-WEB STEEL JOISTS AND JOIST GIRDERS				
1. Installation of open-web steel joists and joist girders.				
a. End connections - welding or bolted.	per SJI CJ or SJI 100		Y	Periodic
b.. Bridging - horizontal or diagonal.				
1) Standard bridging.	per SJI CJ or SJI 100		Y	Periodic

2) Bridging that differs from the specifications listed in SJI CJ or SJI 100.			Y	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.2.4 COLD-FORMED STEEL TRUSSES SPANNING 60 FEET OR GREATER				
Verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field Inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.3 CONCRETE CONSTRUCTION				
1. Inspect reinforcement, including prestressing tendons, and verify placement.	Shop ⁽³⁾ and field inspection	ACI 318: 20, 25.2, 25.3, 26.6.2-26.6.3	Y	Periodic
2. Reinforcing bar welding:				
a. Verification of weldability of bars other than ASTM A706.		AWS D1.4	N	Periodic
b. Inspection of single-pass fillet welds 5/16 or less in size.		ACI 318: 26.6.4	N	Periodic
c. Inspection of all other welds.			N	Continuous
3. Inspection of anchors cast in concrete.	Shop ⁽³⁾ and field inspection		Y	Periodic
4. Inspection of anchors post-installed in hardened concrete members per research reports, or, if no specific requirements are provided, requirements shall be provided by the registered design professional and approved by the building official, including verification of anchor type, anchor dimensions, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete minimum thickness, anchor embedment and tightening torque	Field inspection		Y	Periodic or as required by the research report issued by an approved source

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a. Adhesive anchors installed in horizontal or upward-inclined orientation that resist sustained tension loads.	Field inspection	ACI 318: 17.8.2.4	Y	Continuous
b. Mechanical and adhesive anchors note defined in 4a.	Field inspection	ACI 318: 17.8.2	Y	Periodic
5. Verify use of approved design mix	Shop ⁽³⁾ and field inspection	ACI 318: 19, 26.4.3, 26.4.4	Y	Periodic
6. a. Prior to placement, fabricate specimens for strength tests, fresh concrete sampling, perform slump or slump flow, and air content density tests, and determine temperature of concrete.	Shop ⁽³⁾ and field inspection	ASTM C172, ASTM C31, ACI 318: 26.5, 26.12	Y	Continuous
6. b. Verify that concrete specimens for strength tests are maintained in the required initial curing and laboratory curing environment, and that the maximum and minimum temperatures during the initial curing period are reported.	Shop ⁽³⁾ and field inspection		Y	Continuous
7. Inspection of concrete and shotcrete placement for proper application techniques	Shop ⁽³⁾ and field inspection	ACI 318: 26.5	Y	Continuous
8. Verify maintenance of specified curing temperature and techniques	Shop ⁽³⁾ and field inspection	ACI 318: 26.5.3-26.5.5	Y	Periodic
9. Inspection of prestressed concrete:	Shop ⁽³⁾ and field inspection			
a. Application of prestressing force		ACI 318: 26.10	N	Continuous
b. Grouting of bonded prestressing tendons		ACI 318: 26.10	N	Continuous
10. Inspect erection of precast concrete members		ACI 318: 26.9	Y	Periodic
11. Verification of in-situ concrete strength, prior to stressing of tendons in post tensioned concrete and prior to removal of shores and forms from beams and structural slabs	Review field testing and laboratory reports	ACI 318: 26.11.2	N	Periodic
12. Inspection of formwork for shape, lines, location and dimensions	Field inspection	ACI 318: 26.11.1.2(b)	Y	Periodic
13. Concrete strength testing and verification of compliance with construction documents	Field testing and review of laboratory reports		Y	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES

PROJECT	

MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.4 MASONRY CONSTRUCTION				
MINIMUM VERIFICATION REQUIREMENTS				
(A) Level A, B and C Quality Assurance:				
1. Prior to construction, verification of compliance of submittals	Submittal Review	TMS 602: 1.5	Y	Prior to Construction
(B) Level B and C Quality Assurance:				
1. Prior to construction verification of f'm and fAAC except where specifically exempted by the code	Testing by unit strength method or prism test method	TMS 602: 1.4B	Y	Prior to Construction
2. During construction, verification of proportions of materials as delivered to the project site for premixed or pre-blended mortar, prestressing grout, and grout other than self-consolidating grout.	Testing by unit strength method or prism test method		Y	Periodic
(C) Level C Quality Assurance:				
1. During construction, verification of f'm and fAAC for every 5,000 SF	Testing by unit strength method or prism test method	TMS 602: 1.4B	Y	Periodic
2. During construction, verification of proportions of materials as delivered to the project site for premixed or pre-blended mortar, prestressing grout, and grout other than self-consolidating grout.	Field inspection		Y	Periodic
MINIMUM SPECIAL INSPECTION REQUIREMENTS				
(D) Levels B and C Quality Assurance:				
1. As masonry construction begins, verify that the following are in compliance:				
a. Proportions of the site-prepared mortar	Field inspection	TMS 602: 2.1, 2.6A	Y	Periodic
b. Grade and size of prestressing tendons and anchorages	Field inspection	TMS 602: 2.4B, 2.4H	Y	Periodic
c. Grade, type, and size of reinforcement, anchor bolts, and prestressing tendons and anchorages	Field inspection		Y	Periodic
d. Prestressing technique	Field inspection	TMS 602: 3.6B	N	Periodic
e. Properties of thin-bed mortar for AAC masonry	Field inspection	TMS 602: 2.1C	N	Level B - Continuous ^(b) Level B - Periodic ^(c)
(b) Required for the first 5,000 square feet (c) Required after the first 5,000 square feet			N	Level C - Continuous
f. Sample panel construction			Field inspection	

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			Y	Level C - Continuous
2. Prior to grouting, verify that the following are in compliance:				
a. Grout space	Field Inspection	TMS 602: 3.2D, 3.2F	Y	Level B - Periodic
			Y	Level C - Continuous
b. Placement of prestressing tendons and anchorages	Field Inspection		Y	Periodic
c. Placement of reinforcement, connectors, and anchor bolts	Field Inspection		Y	Level B - Periodic
			Y	Level C - Continuous
d. Proportions of site-prepared grout and pre-stressing grout for bonded tendons	Field Inspection		Y	Periodic
3. Verify compliance of the following during construction:				
a. Materials and procedures with the approved submittals	Field inspection		Y	Periodic
b. Placement of masonry units and mortar joint construction	Field inspection		Y	Periodic
c. Size and location of structural members	Field inspection	TMS 602: 3.3F	Y	Periodic
d. Type, size, location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction	Field inspection	TMS 402: 1.2.1(e), 6.1.4.3, 6.2.1	Y	Level B - Periodic
			Y	Level C - Continuous
e. Welding of reinforcement	Field inspection	TMS 402: 8.1.6.7.2, 9.3.3.4, 11.3.3.4(b)	N	Continuous
f. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F) or hot weather (temperature above 90°F)	Field inspection	TMS 602: 1.8C, 1.8D	Y	Periodic
g. Application and measurement of prestressing force	Field testing	TMS 602: 3.6B	N	Continuous
h. Placement of grout and prestressing grout for bonded tendons is in compliance	Field inspection	TMS 602: 3.5, 3.6C	N	Continuous
i. Placement of AAC masonry units and construction of thin-bed mortar joints	Field inspection	TMS 602: 3.3B.9, 3.3F.1.b	Y	Level B - Continuous ^(b) Level B - Periodic ^(c)
(b) Required for the first 5,000 square feet (c) Required after the first 5,000 square feet			Y	Level C - Continuous

4. Observe preparation of grout specimens, mortar specimens, and/or prisms	Field inspection	TMS 602: 1.4B.2.a.3, 1.4B.2.b.3, 1.4B.2.c.3, 1.4B.3, 1.4B.4	Y	Level B - Periodic
			Y	Level C - Continuous

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.5 WOOD CONSTRUCTION				
1. For prefabricated wood structural elements, inspection of the fabrication process and assemblies in accordance with Section 1704.2.5.	In-plant review ⁽³⁾		N	Periodic
2. For high-load diaphragms, verify grade and thickness of structural panel sheathing agree with approved building plans.	Field inspection		N	Periodic
3. For high-load diaphragms, verify nominal size of framing members at adjoining panel edges, nail or staple diameter and length, number of fastener lines, and that spacing between fasteners in each line and at edge margins agree with approved building plans	Field inspection		N	Periodic
4. Metal-plate-connected wood trusses:				
a. Verification that permanent individual truss member restraint/bracing has been installed in accordance with the approved truss submittal package when the truss height is greater than or equal to 60".	Field inspection		N	Periodic
b. For trusses spanning 60 feet or greater: verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.5.3 MASS TIMBER CONSTRUCTION				

1. Inspection of anchorage and connection of mass timber construction to timber deep foundation systems.	Field inspection		N	Periodic
2. Inspect erection of mass timber construction.	Field inspection		N	Periodic
3. Inspection of connections where installation methods are required to meet design loads.				
a. Threaded Fasteners				
1) Verify use of proper installation equipment.	Field inspection		N	Periodic
2) Verify use of pre-drilled holes where required.	Field inspection		N	Periodic
3) Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.	Field inspection		N	Periodic
b. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.	Field inspection		N	Periodic
c. Other adhesive anchors.	Field inspection		N	Periodic
d. Bolted connections.	Field inspection		N	Periodic
e. Concealed connections	Field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.6 SOILS				
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	Field inspection		Y	Periodic
2. Verify excavations are extended to proper depth and have reached proper material.	Field inspection		Y	Periodic
3. Perform classification and testing of compacted fill materials.	Field inspection		Y	Periodic
4. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of controlled fill	Field inspection		Y	Continuous
5. Prior to placement of controlled fill, inspect subgrade and verify that site has been prepared properly	Field inspection		Y	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.7 DRIVEN DEEP FOUNDATIONS				
1. Verify element materials, sizes and lengths comply with requirements	Field inspection		N	Continuous
2. Determine capacities of test elements and conduct additional load tests, as required	Field inspection		N	Continuous
3. Inspect driving operations and maintain complete and accurate records for each element	Field inspection		N	Continuous
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	Field inspection		N	Continuous
5. For steel elements, perform additional inspections per Section 1705.2	See Section 1705.2		N	See Section 1705.2
6. For concrete elements and concrete-filled elements, perform tests and additional inspections per Section 1705.3	See Section 1705.3		N	See Section 1705.3
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge	Field inspection		N	In accordance with construction documents

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.8 CAST-IN-PLACE DEEP FOUNDATIONS				
1.Inspect drilling operations and maintain complete and accurate records for each element	Field inspection		N	Continuous
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into	Field inspection		N	Continuous

bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes				
3. For concrete elements, perform tests and additional inspections in accordance with Section 1705.3	See Section 1705.3		N	See Section 1705.3

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.9 HELICAL PILE FOUNDATIONS				
Verify installation equipment, pile dimensions, tip elevations, final depth, final installation torque and other installation data as required by construction documents.	Field inspection		N	Continuous

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.10 FABRICATED ITEMS				
1. List of fabricated items requiring special inspection during fabrication:	Shop inspection		Y	As noted in each applicable shop activity
Open-web steel joists				
Joist Girders				
Structural steel fabricator				
2. List of fabricated items to be fabricated on the premises of a fabricator approved to perform such work without special inspection (including name of approved agency providing periodic auditing):	Shop inspection		Y	As noted in each applicable shop activity
Open-web joists				
Joist girders				
Structural steel fabricator				

SCHEDULE OF SPECIAL INSPECTION SERVICES			
PROJECT			
MATERIAL / ACTIVITY	SERVICE		APPLICABLE

		REFERENCED STANDARD	Y/N	FREQUENCY
1705.11.1 STRUCTURAL WOOD SPECIAL INSPECTIONS FOR WIND RESISTANCE				
1. Inspection of field gluing operations of elements of the main wind force-resisting system	Field inspection		N	Continuous
2. Inspection of nailing, bolting, anchoring and other fastening of components within the main wind force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.	Shop ⁽³⁾ and field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.11.2 COLD-FORMED STEEL SPECIAL INSPECTIONS FOR WIND RESISTANCE				
1.Inspection during welding operations of elements of the main wind force-resisting system	Shop ⁽³⁾ and field inspection		N	Periodic
2. Inspection of screw attachment, bolting, anchoring and other fastening of components within the main wind force-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.	Shop ⁽³⁾ and field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.11.3 WIND-RESISTING COMPONENTS				
1. Roof covering, roof deck and roof framing connections.	Shop ⁽³⁾ and field inspection		N	Periodic
2. Exterior wall covering and wall connections to roof and floor diaphragms.	Shop ⁽³⁾ and field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY

1705.12.1 STRUCTURAL STEEL SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

1. Seismic force-resisting systems in SDC B, C, D, E, or F.	Shop ⁽³⁾ and field inspection		N	In accordance with AISC 341
2. Structural steel elements in SDC B, C, D, E, or F other than those in Item 1. including struts, collectors, chords and foundation elements.	Shop ⁽³⁾ and field inspection		N	In accordance with AISC 341

SCHEDULE OF SPECIAL INSPECTION SERVICES

PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY

1705.12.2 STRUCTURAL WOOD SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

1. Field gluing operations of elements of the seismic-force resisting system for SDC C, D, E or F.	Shop ⁽³⁾ and field inspection		N	Continuous
2. Nailing, bolting, anchoring and other fastening of components within the seismic-force-resisting system including wood shear walls, wood diaphragms, drag struts, shear panels and hold-downs for SDC C, D, E or F.	Shop ⁽³⁾ and field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES

PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY

1705.12.3 COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

1. During welding operations of elements of the seismic-force-resisting system for SDC C, D, E or F.	Shop ⁽³⁾ and field inspection		N	Periodic
2. Screw attachment, bolting, anchoring and other fastening of components within the seismic-force-resisting system including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs for SDC C, D, E or F.	Shop ⁽³⁾ and field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES

PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY

1705.12.4 DESIGNATED SEISMIC SYSTEMS VERIFICATION SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

For SDC C, D, E or F, inspect and verify that the component label, anchorage or mounting conforms to the certificate of compliance in accordance with ASCE 7 Section 13.2.2.	Field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES

PROJECT		REFERENCED STANDARD	APPLICABLE	
MATERIAL / ACTIVITY	SERVICE		Y/N	FREQUENCY

1705.12.5 ARCHITECTURAL COMPONENTS SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

1. For SDC D, E or F, inspection during the erection and fastening of exterior cladding and interior or exterior veneer more than 30 feet above grade or walking surface and weighing more than 5 psf.	Field inspection		N	Periodic
2. For SDC D, E or F, inspection during the erection and fastening of interior nonloadbearing walls more than 30 feet above grade or walking surface and weighing more than 15 psf.	Field inspection		N	Periodic
3. For SDC D, E or F, inspection during the erection and fastening of exterior nonloadbearing walls more than 30 feet above grade or walking surface.	Field inspection		N	Periodic
4. For SDC D, E or F, inspection during anchorage of access floors	Field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES

PROJECT		REFERENCED STANDARD	APPLICABLE	
MATERIAL / ACTIVITY	SERVICE		Y/N	FREQUENCY

1705.12.6 PLUMBING, MECHANICAL AND ELECTRICAL COMPONENTS SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

1. Inspection during the anchorage of electrical equipment for emergency or standby power systems in SDC C, D, E or F	Field inspection		N	Periodic
2. Inspection during the anchorage of other electrical equipment in SDC E or F	Field inspection		N	Periodic

3. Inspection during installation and anchorage of piping systems designed to carry hazardous materials, and their associated mechanical units in SDC C, D, E or F	Field inspection		N	Periodic
4. Inspection during the installation and anchorage of HVAC ductwork designed to contain hazardous materials in SDC C, D, E or F	Field inspection		N	Periodic
5. Inspection during the installation and anchorage of vibration isolation systems in SDC C, D, E or F where nominal clearance of 1/4 inch or less is required by the approved construction documents	Field inspection		N	Periodic
6. Inspection during installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic fire sprinkler systems are installed in structures assigned to SDC C, D, E, or F to verify one of the following unless flexible sprinkler hose fittings are used:				
a. Minimum required clearances have been provided.	Field inspection	ASCE/SEI 7: 13.2.3	N	Periodic
b. A three inch or greater nominal clearance has been provided between fire protection sprinkler system drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.	Field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.12.7 STORAGE RACKS SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE				
Inspection during the anchorage of storage racks 8 feet or greater in height in structures assigned to SDC D, E or F.	Field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES

PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.12.8 SEISMIC ISOLATION SYSTEMS				
Inspection during the fabrication and installation of isolator units and energy dissipation devices used as part of the seismic isolation system in structures assigned to SDC B, C, D, E or F.	Shop ⁽³⁾ and field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.12.9 COLD-FORMED STEEL SPECIAL BOLTED MOMENT FRAMES				
Inspection of installation of cold-formed steel special bolted moment frames in the seismic force-resisting systems in structures assigned to SDC D, E or F.	Field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.13.1 STRUCTURAL STEEL TESTING FOR SEISMIC RESISTANCE				
1. Nondestructive testing of structural steel in the seismic force-resisting systems in accordance with AISC 341 in structures assigned to SDC B, C, D, E or F.	Field test		N	Periodic
2. Nondestructive testing of structural steel elements in the seismic force-resisting systems not covered in 1 above including struts, collectors, chords and foundation elements in accordance with AISC 341 in structures assigned to SDC B, C, D, E or F.	Field test		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY

1705.13.2 SEISMIC CERTIFICATION ON NON-STRUCTURAL COMPONENTS

Review certificate of compliance for designated seismic system components in structures assigned to SDC B, C, D, E or F.	Certificate of compliance review		N	Each submittal

SCHEDULE OF SPECIAL INSPECTION SERVICES

PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.13.3 SEISMIC CERTIFICATION OF DESIGNATED SEISMIC SYSTEMS				
Review certificate of compliance for designated seismic system components in structures assigned to SDC C, D, E or F	Certificate of compliance review		N	Each submittal

SCHEDULE OF SPECIAL INSPECTION SERVICES

PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.13.4 SEISMIC ISOLATION SYSTEMS				
Test seismic isolation system in structures assigned to SDC B, C, D, E or F.	Prototype testing	ASCE 7: 17.8	N	Per ASCE 7

SCHEDULE OF SPECIAL INSPECTION SERVICES

PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.14 SPRAYED FIRE-RESISTANT MATERIALS				
1. Verify surface condition preparation of structural members	Field inspection		N	Periodic
2. Verify minimum thickness of sprayed fire-resistant materials applied to structural members	Field inspection		N	Periodic
3. Verify density of the sprayed fire-resistant material complies with approved fire-resistant design	Field inspection		N	Per Section 1705.14.5
4. Verify the cohesive/adhesive bond strength of the cured sprayed fire-resistant material	Field inspection		N	Per Section 1705.14.6
5. Condition of finished application	Field inspection		N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.13.15 MASTIC AND INTUMESCENT FIRE-RESISTANT COATINGS				
Inspect and test mastic and intumescent fire-resistant coatings applied to structural elements and decks	Field inspection and testing	AWCI 12-B	N	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.13.16 EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS)				
Inspection of water-resistive barrier over sheathing substrate	Field inspection		Y	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.13.17 FIRE-RESISTANT PENETRATIONS AND JOINTS				
1. Inspect penetration firestop systems	Field testing		Y	Per ASTM E2174
2. Inspect fire-resistant joint systems	Field testing		Y	Per ASTM E2393

SCHEDULE OF SPECIAL INSPECTION SERVICES				
PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.13.18 SMOKE CONTROL SYSTEMS				
1. Leakage testing and recording of device locations prior to concealment	Field testing		Y	Periodic
2. Prior to occupancy and after sufficient completion, pressure difference testing, flow measurements, and detection and control verification	Field testing		Y	Periodic

SCHEDULE OF SPECIAL INSPECTION SERVICES				

PROJECT				
MATERIAL / ACTIVITY	SERVICE	REFERENCED STANDARD	APPLICABLE	
			Y/N	FREQUENCY
1705.13.19 SEALING OF MASS TIMBER CONSTRUCTION				
1. Inspect sealants and adhesives to resist passage of air in buildings of Type IV-A, IV-B, and IV-C.	Field testing		N	Periodic
a. At abutting edges and intersections of mass timber building elements required to be fire-resistance rated.	Field testing		N	Periodic
b. At abutting intersections of mass timber building elements and building elements of other materials where both are required to be fire-resistance rated.	Field testing		N	

* INSPECTION AGENTS		
FIRM	ADDRESS	TELEPHONE NO.
1.		
2.		
3.		
4.		
Notes: 1. The inspection and testing agent(s) shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official prior to commencing work. The qualifications of the Special Inspector(s) and/or testing agencies may be subject to the approval of the Building Official and/or the Design Professional. 2. The list of Special Inspectors may be submitted as a separate document, if noted so above. 3. Shop Inspections of fabricated items are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.1 and listed in activity 1709.2. 4. Observe: Observe on a random basis, operations need not be delayed pending these inspections. Perform: These tasks shall be performed for each welded joint, bolted connection, or steel element. 5. NDT of welds completed in an approved fabricator's shop may be performed by that fabricator when approved by the AHJ. Refer to AISC 360, N6. Are Special Inspections for Seismic Resistance included in the Statement of Special Inspections? Yes No Are Special Inspections for Wind Resistance included in the Statement of Special Inspections? Yes No DATE: _____		

END OF SECTION

ITEM 627.0002 25**EXISTING CONDITIONS****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.
- 1.02 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0002 25**EXISTING CONDITIONS****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

- A. Section 024119 SELECTIVE STRUCTURE DEMOLITION
- B. Section 028213 ASBESTOS ABATEMENT

1.02 This item shall include, but not be limited to, the following:

- A. Demolition and removal of roofing, roof accessories, as well as a portion of the existing building and its furnishings
- B. Demolition and removal of ACM including roofing, caulking, mastics

1.03 Items specifically not paid for under this item shall include, but not be limited to, the following:

- A. Not Used

SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected portions of building MEP systems.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- C. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition 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.

1.4 PREINSTALLATION MEETINGS

- A. Predemolition 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.
 - 5. Review areas that could potentially contain hazardous materials where selective demolition operations might expose these materials.

1.5 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for environmental protection and for dust control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.

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- C. Predemolition Photographs or Video: Submit before Work begins. Coordinate with Owner which portions of work have to be documented.
- D. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

- A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.7 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: Hazardous materials are identified in Section 003126. In case of unexpected uncovering of hazardous materials:
 - 1. If unforeseen suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. If additional hazardous materials are identified they will be removed under a change to the contract.
 - 2. Contractor shall utilize lead-safe work practices working in areas where lead-based paint is present.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS**2.1 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/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or preconstruction videotapes.
 - 1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems to maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove plumbing and electrical systems, equipment, and components indicated 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.
 - 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.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: 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. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."
- C. Temporary Shoring: 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.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain adequate ventilation when using cutting torches.
 - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 9. Dispose of demolished items and materials promptly.

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- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 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 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 indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.
 - 1. If materials are removed by asbestos abatement refer to the asbestos abatement specification.
- F. Air-Conditioning Equipment: Remove equipment without releasing refrigerants

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 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.
- B. Burning: Do not burn demolished materials.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 028213 – ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This asbestos abatement Project will consist of the removal and disposal of asbestos containing materials at the **NYSTA Section Maintenance Complex MP 340.15 in Manchester, New York.** The scope of work is indicated on the drawings.
- B. Provide abatement of large, small and minor amounts of asbestos in accordance with definition and descriptions of Code 56 and as follows.
- C. This Section includes the following:
 - 1. Demolition and removal of ACM including the following:
 - a. Roof trim.
 - b. Caulking.
- D. The Contractor shall be aware of all conditions of the Project and is responsible for verifying quantities and locations of all Work to be performed. Failure to do so shall not relieve the Contractor of its obligation to furnish all labor and materials necessary to perform the work.
- E. All Work shall be performed in strict accordance with the Project Documents and all governing codes, rules, and regulations. Where conflicts occur between the Project Documents and applicable codes, rules, and regulations, the more stringent shall apply.
- F. Working hours shall be as required and approved by the Owner. Asbestos abatement activities including, but not limited to, work area preparation, gross removal activities, cleaning activities, waste removal, etc. may need to be performed during ‘off-hours’ (including nights and weekends). In addition, multiple mobilizations may be required to perform the work identified in this project. The Contractor shall coordinate all Work with the facility and Owner’s representative regarding scheduling.
- G. No Site-Specific Variances have been obtained for this project. The Contractor may apply for such Site-Specific Variances at their option. Payment for such variances shall be paid for by the contractor. Use of such variances shall be subject to approval by the architect and Owner’s representative.
- H. Change Orders Due to Variances: Any variance to Regulatory Requirements submitted by the Contractor and approved by the Regulatory Agency shall be executed upon approval by the Owner pursuant to review of change in scope of work and change in contract cost resulting in cost.
 - 1. Variances which include the use of a remote personal decontamination enclosure system for interior abatement will not be permitted when asbestos removal includes friable material other than vinyl asbestos tile or approved glove bag operations.

1.2 RELATED SECTIONS

- A. Division 02 Section "Selective Demolition" for demolition of selected portions of buildings and structures that are not ACM.
- B. Division 07 Section “Preparation for Re-roofing” for roofing removal work that precedes or is coincident with ACM removal at roof areas.

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1.3 DEFINITIONS

- A. Abatement: Any portion of a Project that included procedures to control release from any asbestos containing material. This includes removal, encapsulation, repair or handling or possible exposure from construction related work that may result in the release of asbestos fibers.
- B. ACM: Asbestos-containing materials or asbestos-contaminated materials. Refer to Division 00 Section "Existing Hazardous Materials Information" for reports providing information on existing ACM.
- C. Regulatory Requirements: Laws, rules and regulations of authorities having jurisdiction over the handling, removal, transportation and disposal of ACM, including local, state and federal regulations listed under "Quality Assurance" article.
- D. Remove: Detach items from existing construction and legally dispose of them off-site.
- E. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 PERMITS AND COMPLIANCE

- A. The Contractor shall assume full responsibility and liability for compliance with all applicable Federal, State, and local laws, rules, and regulations pertaining to Work practices, protection of Workers, authorized visitors to the site, persons, and property adjacent to the Work.
- B. Perform asbestos related Work in accordance with New York State Industrial Code Rule 56, 40 CFR 61, and 29 CFR 1926, as specified herein. Where more stringent requirements are specified, adhere to the more stringent requirements. Effective September 5, 2006 all work conducted must be in accord with amended ICR-56 that was adopted on March 21, 2007.
- C. The Contractor and its Subcontractors performing asbestos abatement work must maintain current licenses pursuant to New York State Department of Labor and Department of Environmental Conservation for all Work related to this Project, including the removal, handling, transport, and disposal of asbestos containing materials. The Contractor is responsible for making sure that its Subcontractors performing this work are compliant with the amended ICR 56.
- D. The Contractor must have and submit proof upon request that any persons employed by the Contractor to engage in or supervise Work on any asbestos Project have a valid NYS asbestos handling certificate pursuant to Industrial Code Rule 56.
- E. The Contractor shall comply fully with any variances secured from regulatory agencies following Owner approval in the performance of the Work. Should the Contractor choose to apply for a site specific variance, approval of the Owner is first required. Any Contractor submitted petition for a site specific variance must be submitted by the Contractor (at his/her own cost) a minimum of two weeks prior to commencement of the project. Any petition for variance must be completed and submitted by a person possessing a valid NYSDOL Project Designer certification.
- F. It is the sole responsibility of the Contractor to determine what, if any, patents are applicable to the Project. The Contractor shall pay all royalties and/or license fees. He shall defend all suits or claims for infringement of any patent rights and save the Owner, Architect, Engineer, Environmental Consultant, and Construction Manager harmless from loss, including attorney's fees, on account thereof.
- G. Failure to adhere to the Project Documents shall constitute a breach of the Contract and the Owner shall have the right to and may terminate the Contract provided, however, the failure of the Owner to so terminate shall not relieve the Contractor from future compliance.

1.5 APPLICABLE STANDARDS AND REGULATIONS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning ACM demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Comply with the current and applicable portions of the following:
1. New York State Regulations:
 - a. 12 NYCRR, Part 56, "Asbestos", Industrial Code Rule 56 adopted March 7, 2007 (DOL) referred to as "Code Rule 56" of the NYS Codes, Rules and Regulations (Statutory Authority: New York State Labor Law Section 906).
 - 1) Exception: Variances obtained in accordance with Article 30 of the Labor Law.
 - b. 6 NYCRR, Parts 360, 364, Disposal and Transportation (DEC)
 - c. 10 NYCRR, Part 73, "Asbestos Safety Program Requirements" (DOH)
 - d. 12NYCRR56, New York State School Asbestos Safety Act (SASA).
 2. Federal Regulations:
 - a. Asbestos Hazard Emergency Response Act (AHERA) regulations, EPA Final Rule and Notice for Asbestos-Containing Material in Schools, 40 CFR Part 763.
 - b. 29 CFR 1910.1001, "Asbestos" (OSHA)
 - c. 29 CFR 1910.1200, "Hazard Communication" (OSHA)
 - d. 29 CFR 1910.134, "Respiratory Protection" (OSHA)
 - e. 29 CFR 1910.145, "Specification for Accident Prevention Signs and Tags" (OSHA)
 - f. 29 CFR 1926, "Construction Industry" (OSHA)
 - g. 29 CFR 1926.1101, "Asbestos, Tremolite, Anthophyllite, and Actinolite" (OSHA)
 - h. 29 CFR 1926.500 "Guardrails, Handrails and Covers" (OSHA)
 - i. 40 CFR 61, Subpart A, "General Provisions" (EPA)
 - j. 40 CFR 61, Subpart M, "National Emission Standard for Asbestos" (EPA)
 - k. 49 CFR 171-172, Transportation Standards (DOT)
 3. Regulations and Requirements of NYS Agencies :
 - a. Building Code of New York State (BCNYS).
 - b. New York State Education Department (SED).
 - c. New York State Department of Labor (DOL).
 - d. New York State Department of Health (DOH).
 - e. New York State Department of Environmental Conservation (DEC).
 4. Regulations and Requirements of Federal Agencies:
 - a. Occupational Safety and Health Administration (OSHA).
 - b. United States Environmental Protection Agency (EPA).
 5. National Standards:
 - a. National Electrical Code (NEC).
- B. Standards and Guidance Documents:
1. American National Standard Institute (ANSI) Z88.2-80, Practices for Respiratory Protection
 2. ANSI Z9.2-79, Fundamentals Governing the Design and Operation of Local Exhaust Systems
 3. EPA 560/585-024, Guidance for Controlling Asbestos Containing Materials in Buildings (Purple Book)
 4. EPA 530-SW-85-007, Asbestos Waste Management Guidance

1.6 QUALITY ASSURANCE

- A. ACM Demolition Firm Qualifications: A fully-licensed, certified and experienced firm that has qualified workers specialized in ACM demolition work similar in material and extent to that indicated for this Project.
1. Firms shall be EPA-certified, and as follows:
 - a. Firms shall be certified by the NYS Commissioner of Labor.
 2. Workers shall have successfully completed an EPA-certified safety training program, and as follows:
 - a. All workers shall be certified by the NYS Department of Health.
 3. Firms that employ workers who are fully licensed and certified in accordance with Regulatory Requirements to perform the Work indicated may be qualified as determined by the Architect.

1.7 SUBMITTALS

- A. Qualification Data: For firm and workers performing ACM demolition.
1. Licenses and certifications.
 - a. EPA Certifications.
 - b. NYS Asbestos Handling Licenses.
 2. Notice of Project Commencement: Per EPA requirements.
- B. Schedule of ACM Demolition Activities: Indicate the following:
1. Detailed sequence of ACM demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 2. Locations and construction of proposed containment partitions and means of egress.
 3. Work area entry and exit procedures.
 4. Equipment and waste container decontamination and removal procedures, including waste decontamination enclosure systems.
 5. Signage as required.
 6. Locations and construction of proposed personal decontamination enclosure systems.
 7. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 8. Means of protection for items to remain and items in path of ACM waste removal from building.
- C. Pre-Work Submittals: Within 7 days prior to the pre-construction conference, the Contractor shall submit 3 copies of the documents listed below:
1. Contractor and Subcontractor licenses issued by New York State Department of Labor.
 2. A list of all Workers used in the performance of the Project, including name and a copy of their current NYSDOL Asbestos certification.
 3. For each Worker used in the performance of the Project, submit required employee statements including current Medical Examination Statement, current asbestos training certification, Worker's Acknowledgment Statement, Respirator Fit Test, and Employee Training Statement.
 4. A list of Projects performed within the past two (2) years including the dollar value of all Projects. Provide Project references to include Owner, consultant, and air monitoring firm's name, contact persons, address, and phone number.
 5. Progress Schedule:
 6. Show the complete sequence of abatement activities and the sequencing of Work within each building or building section.
 7. Show the dates for the beginning and completion of each major element of Work including substantial completion dates for each Work Area, building, or phase.

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8. Project Notifications: As required by Federal and State regulatory agencies together with proof of transmittal (i.e. certified mail return receipt).
 9. Building Occupant Notification: As required by regulatory agencies.
 10. Abatement Work Plan: Provide plans that clearly indicate the following:
 - a. All Work Areas/containments numbered sequentially.
 - b. Locations and types of all decontamination enclosures.
 - c. Entrances and exits to the Work Areas/containments.
 - d. Type of abatement activity/technique for each Work Area/containment.
 - e. Waste transport routes through the building to the waste storage container.
 11. Disposal Site/Landfill Permit from applicable regulatory agency.
 12. NYS Department of Environmental Conservation Waste Transporter Permit.
 13. Material Safety Data Sheets of supplies/chemicals to be used on the Project.
- D. Project Close-out Submittals: Within 30 days of project completion, the Contractor shall submit (3) bound copies of Project Records, Logs, Inspections and Chain-of-Custody per Regulatory Requirements.
1. **Originals** of all waste disposal manifests, seals, and disposal logs.
 2. Daily progress log, including the entry/exit log.
 3. Final project notifications and variances.
 4. Submit all material, product and equipment data used by the Contractor during the asbestos abatement project, including manufacturer's name, specifications and application instructions for surfactants, encapsulants and removal equipment.
 5. Submit manufacturer's data regarding EPA- and OSHA-approved containment, storage products, and removal equipment.
- E. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
1. Submit name and permit of the Industrial Waste Hauler in accordance with Title 6 NYCRR364 for transporting of waste asbestos-containing materials to a disposal site. Include authorization from the intended disposal site.
 2. Submit name and permit in accordance with Title 6 NYCRR360, issued by the NYS DEC for acceptable landfill sites.

1.8 NOTICES

- A. The Contractor shall provide notification of intent to commence asbestos abatement activities as indicated below.
1. At least ten (10) Working days prior to beginning abatement activities, send written notification to:

U.S. Environmental Protection Agency
National Emissions Standards for Hazardous Air Pollutants (NESHAPS) Coordinator
26 Federal Plaza
New York, NY 10007.
 2. At least ten (10) days prior to beginning abatement activities send written notification to:

New York State Department of Labor
Division of Safety and Health, Asbestos Control Program.
State Office Campus
Building 12 - Room 454
Albany, NY 12240
- B. The Contractor is required to send notifications to regulatory agencies via mail or package delivery service that will provide proof of delivery and receipt.

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- C. The Contractor shall post and/or provide Building Occupant Notification at least 10 days prior to beginning abatement activities as required by NYS Industrial Code Rule 56. The posting shall include the following information:
1. The locations of the abatement Project.
 2. The amounts and types of asbestos containing materials being abated.
 3. The commencement and completion dates of the Project.
 4. The name, address, and asbestos license number of the Abatement Contractor.
 5. The name, address, and asbestos license number of the Environmental Consultant and laboratory.

1.9 PROJECT SUPERVISOR

- A. The Contractor shall designate a full-time Project Supervisor who shall meet the following qualifications:
1. The Project Supervisor shall hold New York State certification as an Asbestos Supervisor.
 2. The Project Supervisor shall meet the requirements of a "Competent Person" as defined by OSHA 1926.1101 and shall have a minimum of one year experience as a supervisor.
 3. The Project Supervisor must be able to read and write English fluently, as well as communicate in the primary language of the Workers.
- B. If the Project Supervisor is not on-site at any time whatsoever, all Work shall be stopped. The Project Supervisor shall remain on-site until the Project is complete. The Project Supervisor cannot be removed from the Project without the written consent of the Owner and the Environmental Consultant. The Project Supervisor shall be removed from the Project if so requested by the Owner.
- C. The Project Supervisor shall maintain the Project Log Book required by New York State Department of Labor and section 2.03 of the specifications and the Waste Disposal Log required by section 4.04 of the specifications.
- D. The Project Supervisor shall be responsible for the performance of the Work and shall represent the Contractor in all respects at the Project site. The Supervisor shall be the primary point of contact for the Asbestos Project Monitor.

1.10 MEDICAL REQUIREMENTS

- A. Before exposure to airborne asbestos fibers, provide Workers with a comprehensive medical examination as required by 29 CFR 1910.1001, and 29 CFR 1926.1101.
1. This examination is not required if adequate records show the employee has been examined as required by 29 CFR 1910.1001, and 29 CFR 1926.1101 within the past year.
 2. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos fibers and within thirty (30) calendar days before or after the termination of employment in such occupations.
- B. As required by 29 CFR 1910.1001, and 29 CFR 1926.1101 maintain complete and accurate records of employees' medical examinations for a period of thirty (30) years after termination of employment and make records of the required medical examinations available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National Institute for Occupational Safety and Health (NIOSH), authorized representatives of either of them, and an employees physician upon the request of the employee or former employee.

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- C. The Contractor shall furnish the Owner evidence of its firm's medical surveillance program required under 29 CFR 1910.1001, and 29 CFR 1926.1101.

1.11 TRAINING

- A. As required by applicable regulations, prior to assignment to asbestos Work instruct each employee with regard to the hazards of asbestos, safety and health precautions, and the use and requirements of protective clothing and equipment.
- B. Establish a respirator program as required by ANSI Z88.2 and 29 CFR 1910.134, and 29 CFR 1926.1101. Provide respirator training and fit testing.

1.12 RESPIRATORY PROTECTION

- A. Select respirators from those approved by the Mine Safety and Health Administration (MSHA), and the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.
- B. Respirators shall be individually fit-tested to personnel under the direction of an Industrial Hygienist on a yearly basis. Fit-tested respirators shall be permanently marked to identify the individual fitted, and use shall be limited to that individual. Fit-test records shall be maintained on site for each employee.
- C. Where fiber levels permit, and in compliance with regulatory requirements, Powered Air Purifying Respirators (PAPR) are the minimum allowable respiratory protection permitted to be utilized during gross removal operations.
- D. No respirators shall be issued to personnel without such personnel participating in a respirator training program.
- E. High Efficiency Particulate Air (HEPA) respirator filters shall be approved by NIOSH and shall conform to the OSHA requirements in 29 CFR 1910.134 and 29 CFR 1926.1101.
- F. A storage area for respirators shall be provided by the Contractor in the clean room side of the personnel decontamination enclosure where they will be kept in a clean environment.
- G. The Contractor shall provide and make available a sufficient quantity of respirator filters so that filter changes can be made as necessary during the work day. Filters will be removed and discarded during the decontamination process. Filters cannot be reused. Filters must be changed if breathing becomes difficult.
- H. Filters used with negative pressure air purifying respirators shall not be used any longer than one eight (8) hour work day.
- I. Any authorized visitor, Worker, or supervisor found in the Work Area not wearing the required respiratory protection shall be removed from the Project site and not be permitted to return.
- J. The Contractor shall have at least two (2) Powered Air Purifying Respirators stored on site designated for authorized visitors use. Appropriate respirator filters for authorized visitors shall be made available by the Contractor.

1.13 DELIVERY AND STORAGE

- A. Deliver all materials to the job site in original packages with containers bearing manufacturer's name and label.
- B. Store all materials at the job site in a suitable and designated area.

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1. Store materials subject to deterioration or damage away from wet or damp surfaces and under cover.
 2. Protect materials from unintended contamination and theft.
 3. Storage areas shall be kept clean and organized.
- C. Remove damaged or deteriorated materials from the job site. Materials contaminated with asbestos shall be disposed of as asbestos debris as herein specified.

1.14 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to ACM demolition area. Conduct ACM 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 ACM demolition.
- D. The work practice of "wrap and cut" will not be permitted as a sole measure of removal without proper containment barriers in place in any areas that will be reoccupied after the abatement work is complete.
- E. Change Orders Due to Variances: Any variance to Regulatory Requirements submitted by the Contractor and approved by the Regulatory Agency shall be executed upon approval by the Owner pursuant to review of change in scope of work and change in contract cost resulting in credit.
- F. Recordkeeping: Comply with Regulatory Requirements.

1.15 SPECIAL JOB CONDITIONS

- A. Any special job conditions, including variances obtained by the Owner or the Contractor, shall be adhered to by the Contractor.

PART 2 - PRODUCTS**2.1 PROTECTIVE CLOTHING**

- A. Provide personnel utilized during the Project with disposable protective whole body clothing, head coverings, gloves and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber for comfort, but shall not be used alone. Make sleeves secure at the wrists and make foot coverings secure at the ankles by the use of tape, or provide disposable coverings with elastic wrists or tops.
- B. Provide sufficient quantities of protective clothing to assure a minimum of four (4) complete disposable outfits per day for each individual performing abatement Work.
- C. Eye protection and hard hats shall be provided and made available for all personnel entering any Work Area.
- D. Authorized visitors shall be provided with suitable protective clothing, headgear, eye protection, and footwear whenever they enter the Work Area.

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2.2 SIGNS AND LABELS

- A. Provide warning signs and barrier tapes at all approaches to asbestos Work Areas. Locate signs at such distance that personnel may read the sign and take the necessary protective steps required before entering the area.

1. Provide danger signs in vertical format conforming to 29 CFR 1926.1101, minimum 20" x 14" displaying the following legend.

DANGER
ASBESTOS CANCER AND LUNG DISEASE
HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA

2. Provide 3" wide yellow barrier tape printed with black lettered, "DANGER ASBESTOS REMOVAL". Locate barrier tape across all corridors, entrances and access routes to asbestos Work Area. Install tape 3' to 4' AFF.

- B. Provide asbestos danger labels affixed to all asbestos materials, scrap, waste, debris and other products contaminated with asbestos.

1. Provide asbestos danger labels of sufficient size to be clearly legible, displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

2. Provide the following asbestos labels, of sufficient size to be clearly legible, for display on waste containers (bags or drums) which will be used to transport asbestos contaminated material in accordance with United States Department of Transportation 49 CFR Parts 171 and 172:

RQ HAZARDOUS
SUBSTANCE
SOLID, NOS
ORM-E, NA 9188
ASBESTOS

3. Generator identification information shall be affixed to each waste container indicating the following printed in indelible ink:

Generator Name:

Facility Name:

Facility Address:

2.3 PROJECT LOG BOOK

- A. Provide a permanently bound Project log book. Log book shall contain on title page the Project name, name, address and phone number of Owner; name, address and phone number of Environmental Consultant; name, address and phone number of Abatement Contractor; emergency numbers including, but not limited to local Fire/Rescue department.

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- B. All entries into the log shall be made in non-washable, permanent ink and such pen shall be strung to or otherwise attached to the log to prevent removal from the log-in area. Under no circumstances shall pencil entries be permitted.
- C. All persons entering and exiting the Work Area shall sign the log and include name, social security number, and time each time they enter the work area.
- D. The Project Supervisor shall document all Work performed daily and note all inspections required by NYS Industrial Code Rule 56, i.e. testing and inspection of barriers and enclosures.

2.4 SCAFFOLDING AND LADDERS

- A. Provide all scaffolding and/or staging as necessary to accomplish the Work of this Contract. Scaffolding may be of suspension type or standing type such as metal tube and coupler, tubular welded frame, pole or outrigger type or cantilever type. The type, erection and use of all scaffolding and ladders shall comply with all applicable OSHA construction industry standards.
- B. Provide scaffolding and ladders as required by the Environmental Consultant for the purposes of performing required inspections.

2.5 SURFACTANT (AMENDED WATER)

- A. Wet all asbestos-containing materials prior to removal with surfactant mixed and applied in accordance with manufacturer's printed instructions.
- B. Approved Manufacturer:
 - 1. International Protective Coatings Corp.: Serpiflex Shield
 - 2. American Coatings Corp.: EPA 55 Asbestos Removal Agent
 - 3. Certified Technologies: CerTane 2075 Penetrating Surfactant
 - 4. Contractor may submit equal. Owner's Representative shall have final approval of equals.

2.6 ENCAPSULANT

- A. Encapsulant shall be tinted or pigmented so that application when dry is readily discernible.
- B. Approved Manufacturer:
 - 1. International Protective Coatings Corp.: Serpiflex Shield
 - 2. American Coatings Corp.: FNE High Temperature Sealant
 - 3. Certified Technologies: CerTane 1000 Post Removal Encapsulant
 - 4. Contractor may submit equal. Owner's Representative shall have final approval of equals.

2.7 DISPOSAL BAGS, DRUMS, AND CONTAINERS

- A. Provide 6 mil polyethylene disposal bags printed with asbestos caution labels. Bags shall also be imprinted with U.S. Department of Transportation required markings.
- B. Provide 30 or 55 gallon capacity fiber or metal drums capable of being sealed air and water tight if asbestos waste has the potential to damage or puncture disposal bags. Affix asbestos caution labels on lids and at one-third points around drum circumference to assure ready identification.
- C. Containers and bags must be labeled with the names of the waste generator and the location at which the waste was generated in accordance with 40 CFR Part 61 NESHAPS.

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- D. Labeled ACM waste containers or bags shall not be used for non-ACM waste or trash. Any material placed in labeled containers or bags, whether turned inside out or not shall be handled and disposed of as ACM waste.

2.8 HEPA VACUUM EQUIPMENT

- A. All dry vacuuming performed under this contract shall be performed with High Efficiency Particulate Absolute (HEPA) filter equipped industrial vacuums conforming to ANSI Z9.2.
- B. Provide tools and specialized equipment including scraping nozzles with integral vacuum hoods connected to a HEPA vacuum with flexible hose.
- C. Approved Manufacturers:
 1. Hako Minuteman
 2. Micro-Trap Inc.
 3. Control Resource Systems, Inc.
 4. Contractor may submit equal. Owner's Representative shall have final approval of equals.

2.9 POWER TOOLS

- A. Any power tools used to drill, cut into, or otherwise disturb asbestos material shall be equipped with HEPA filtered local exhaust ventilation.

2.10 POLYETHYLENE SHEETING

- A. All polyethylene (plastic) sheeting used on the Project (including but not limited to sheeting used for critical and isolation barriers, fixed objects, walls, floors, ceilings, waste container) shall be at least 6 mil fire retardant sheeting.
- B. Decontamination enclosure systems shall utilize at least 6 mil opaque fire retardant plastic sheeting. At least 2 layers of 6 mil reinforced fire retardant plastic sheeting shall be used for the flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of ACM demolition required.

3.2 PREPARATION

- A. Site Access and Temporary Controls: Conduct ACM demolition and removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
 2. Comply with Regulatory Requirements for access and protection to work areas.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

3.3 GENERAL DEMOLITION REQUIREMENTS

- A. Demolish and remove existing construction only to the extent required by ACM removal procedures, to accommodate new construction and as indicated. Use methods required to complete the Work within limitations of Regulatory Requirements and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage existing construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 2. Existing Items to Remain: Protect construction indicated to remain against damage and contamination during ACM demolition in accordance with Regulatory Requirements. When permitted by Architect, items deemed uncontaminated by Regulatory Requirements may be removed to a suitable, protected storage location prior to ACM demolition and cleaned and reinstalled in their original locations after ACM demolition operations are complete.

3.4 GENERAL REQUIREMENTS FOR ABATEMENT WORK

- A. Should the area beyond the Work Area(s) become contaminated with asbestos containing materials or elevated fiber levels immediately stop Work and institute emergency procedures. Contaminated non-Work Areas shall be isolated and decontaminated in accordance with procedures established for asbestos removal. All costs incurred in decontaminating such non-Work Areas and the contents thereof shall be borne by the Contractor, at no additional cost to the Owner.
- B. Medical approval, fit test reports, Worker Acknowledgments, and NYS DOL certificates shall be on site prior to admittance of any Contractor's employees to the asbestos Work Area.
- C. Perform all asbestos removal Work using wet removal procedures. Mix and apply surfactant in accordance with manufacturer's written instructions. Dry removal procedures are not permitted. Sequential abatement of multiple types of ACM within a work area shall be followed by performing "top-down" abatement: most friable to least friable. Complete cleaning at conclusion of each abatement type and subsequent clearance sampling is required per amended ICR-56.
- D. The following submittals, documentation, and postings shall be maintained on-site during abatement activities at a location approved by the Asbestos Project Monitor:
 - 1. Contractor license issued by New York State Department of Labor.
 - 2. Certification, Worker Training, Medical Surveillance, Acknowledgments:
 - a. New York State Asbestos Handler certification cards for each person employed in the removal, handling, or disturbance of asbestos.
 - b. Evidence that Workers have received proper training required by the regulations and the medical examinations required by OSHA 29 CFR 1926.1101.
 - c. Documentation that Workers have been fit tested specifically for respirators used on the Project.
 - d. Worker's Acknowledgments: Statements signed by each employee that the employee has received training in the proper handling of asbestos containing materials; understands the health implications and risks involved; and understands the use and limitations of the respiratory equipment to be used.
 - 3. Daily OSHA personal air monitoring results.
 - 4. NYS Department of Health ELAP certification for the laboratory that will be analyzing the OSHA personnel air samples.
 - 5. NYS Department of Environmental Conservation Waste Transporter Permit.

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6. Project documents (specifications and drawings.)
 7. Notifications and variances (site specific and applicable.) Ensure that the most up-to-date notifications and variances are on-site.
 8. Applicable regulations.
 9. Material Safety Data Sheets of supplies/chemicals used on the Project.
 10. Approved Abatement Work Plan.
 11. List of emergency telephone numbers.
 12. Waste Disposal Log
 13. Project Log Book
- E. The Work Area must be vacated by building occupants prior to decontamination enclosure construction and Work Area preparation.
- F. All demolition necessary to access asbestos containing materials for removal must be conducted within negative pressure enclosures by licensed asbestos handlers. Demolition debris may be disposed of as construction and demolition debris provided the Asbestos Project Monitor determines that it is not contaminated with asbestos. If the demolition debris is determined to be contaminated, it must be disposed of as asbestos waste.

3.5 PERSONNEL DECONTAMINATION ENCLOSURE

- A. Provide a personnel decontamination enclosure contiguous to the Work Area, where applicable. The decontamination enclosure shall be attached to the Work Area and not located within it. If the decontamination chamber is accessible to the public it shall be fully framed and sheathed to prevent unauthorized entry.
- B. Access to the Work Area will be from the clean room through an air-lock to the shower, through an air lock to the equipment room, through an air lock to the Work Area. Each airlock shall be a minimum of three feet from door to door.
- C. The decontamination enclosure ceiling and walls shall be covered with two layers of opaque 6 mil polyethylene sheeting. Two layers of reinforced polyethylene sheeting shall be used to cover the floor.
- D. Establish a triple layer of six mil polyethylene at the decontamination chamber doorways, weighted to insure a tight seal of the enclosure. Prior to establishing doorway seals move all required tools, scaffolding, and equipment into the Work Area.
- E. The entrance to the clean room shall have a lockable door. Provide suitable lockers for storage of Worker's street clothes. Storage for respirators along with replacement filters and disposable towels shall also be provided.
- F. Provide a temporary shower with individual hot and cold water supplies and faucets. Provide a sufficient supply of soap and shampoo. There shall be one shower for every six Workers. The shower room shall be constructed in such a way so that travel through the shower chamber shall be through the shower. The shower shall not be able to be bypassed.
- G. Shower water shall be drained, collected and filtered through a system with at least a 5.0 micron particle size collection capability containing a series of several filters with progressively smaller pore sizes to avoid rapid clogging of the system. The filtered waste water shall then be discharged in accordance with applicable codes and the contaminated filters disposed of as asbestos waste.
- H. The equipment room shall be used for the storage of tools and equipment. A walk-off pan filled with water shall be located in the Work Area outside the equipment room for Workers to clean

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foot coverings when leaving the Work Area. A labeled 6 mil plastic ACM waste bag for collection of contaminated clothing shall be located in this room.

- I. The personal decontamination enclosure shall be cleaned and disinfected minimally at the end of each Work shift and as otherwise directed by the Asbestos Project Monitor.

3.6 WASTE DECONTAMINATION ENCLOSURE

- A. Provide a waste decontamination enclosure contiguous to the Work area. The decontamination enclosure shall be attached to the Work Area and not located within it. If the decontamination chamber is accessible to the public it shall be fully framed and sheathed to prevent unauthorized entry.
- B. The waste decontamination enclosure system shall consist of a washroom/cleanup room with an airlock to the Work Area and another airlock doorway to the holding area. Each airlock shall be a minimum of three feet from door to door. The entrance to the holding area shall have a lockable door.
- C. The decontamination enclosure ceiling and walls shall be covered with two layers of opaque 6 mil polyethylene sheeting. Two layers of reinforced polyethylene sheeting shall be used to cover the floor.
- D. Establish a triple layer of six mil polyethylene at the decontamination chamber doorways, weighted to insure a tight seal of the enclosure. Prior to establishing doorway seals move all required tools, scaffolding, and equipment into the Work Area.
- E. Where there is only one egress from the Work Area, the holding area of the waste decontamination enclosure system may branch off from the personnel decontamination enclosure equipment room, which then serves as the waste wash room.
- F. The waste wash room water shall be drained, collected, and filtered through a system with at least a 5.0 micron particle size collection capability containing a series of several filters with progressively smaller pore sizes to avoid rapid clogging of the system. The filtered waste water shall then be discharged in accordance with applicable codes and the contaminated filters disposed of as asbestos waste.
- G. In small asbestos Projects where only one egress from the Work Area exists, the shower room may be used as a waste washroom. In this instance, the clean room shall not be used for waste storage, but shall be used for waste transfer to carts, which shall immediately be removed from this enclosure.

3.7 REMOVAL OF ASBESTOS CONTAINING MATERIALS

- A. Asbestos-containing materials shall be removed in accordance with the Contract Documents and the approved Asbestos Work Plan.
- B. Sufficiently wet asbestos materials with a low pressure, airless fine spray of surfactant to ensure full penetration prior to material removal. Re-wet material that does not display evidence of saturation.
- C. One Worker shall continuously apply amended water while ACM is being removed.
- D. Perform cutting, drilling, abrading, or any penetration or disturbance of asbestos containing material in a manner to minimize the dispersal of asbestos fibers into the air. Use equipment and methods specifically designed to limit generation of airborne asbestos particles. All power operated tools used shall be provided with HEPA equipped filtered local exhaust ventilation.

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- E. Upon removal of ACM from the substrate, the newly exposed surfaces shall be HEPA vacuumed and/or wet cleaned. Surfaces must be thoroughly cleaned using necessary methods and any required solvents to completely remove any adhesive, mastic, etc.
- F. All removed material shall be placed into 6 mil plastic disposal bags or other suitable container upon detachment from the substrate or whenever there is enough accumulation to fill a single bag or container. Maintain the surfaces of the Work Area free of accumulation of asbestos debris.
- G. Dust-tight enclosed inclined chutes shall be used for materials dropped from distances greater than 10 ft.
- H. Large components shall be wrapped in two layers of 6 mil polyethylene sheeting. Sharp components likely to tear disposal bags shall be placed in fiber drums or boxes and then wrapped with sheeting.
- I. Power or pressure washers are not permitted for asbestos removal or clean-up procedures.
- J. All open ends of pipe and duct insulation not scheduled for removal shall be encapsulated using lag cloth.
- K. All construction and demolition debris determined by the Environmental Consultant to be contaminated with asbestos shall be handled and disposed of as asbestos waste.
- L. The use of metal shovels, metal dust pans, etc. are not permitted inside the work area.

3.8 EQUIPMENT AND WASTE CONTAINER DECONTAMINATION AND REMOVAL PROCEDURES

- A. External surfaces of contaminated containers and equipment shall be cleaned by wet cleaning and/or HEPA vacuuming in the Work Area before moving such items into the waste decontamination enclosure system airlock by persons assigned to this duty. The Work Area persons shall not enter the airlock.
- B. The containers and equipment shall be removed from the airlock by persons stationed in the washroom during waste removal operations. The external surfaces of containers and equipment shall be cleaned a second time by wet cleaning.
- C. The cleaned containers of asbestos material and equipment are to be dried of any excessive pooled or beaded liquid, placed in uncontaminated plastic bags or sheeting, as the item's physical characteristics demand, and sealed airtight.
- D. The clean re-containerized items shall be moved into the airlock that leads to the holding area. Workers in the washroom shall not enter this airlock or the Work Area until waste removal is finished for that period.
- E. Containers and equipment shall be moved from the airlock and into the holding area by persons dressed in clean personal protective equipment, who have entered from uncontaminated areas.
- F. The cleaned containers of asbestos material and equipment shall be placed in water tight carts with doors or tops that shall be closed and secured. These carts shall be held in the holding area pending removal. The carts shall be wet cleaned and/or HEPA vacuumed at least once each day.
- G. The exit from the decontamination enclosure system shall be secured to prevent unauthorized entry.
- H. Where the waste removal enclosure is part of the personnel decontamination enclosure, waste removal shall not occur during shift changes or when otherwise occupied. Precautions shall be taken to prevent short circuiting and cycling of air outward through the shower and clean room.

3.9 APPLICATION OF ENCAPSULANT

- A. Following first cleaning and prior to first sheeting removal, and once Work Area has been rendered free of visible residues; a thin coat of encapsulant shall be applied to any surfaces in the Work Area which were not the subject of removal.
- B. In no event shall encapsulant be applied to any surface that was the subject of removal prior to obtaining satisfactory air monitoring results.
- C. Encapsulants shall be pigmented or tinted to provide an indication for completeness of coverage. The Asbestos Project Monitor shall determine adequacy of coverage.

3.10 WORK AREA DECONTAMINATION

- A. Following completion of gross abatement and after all accumulations of asbestos waste materials have been containerized, the following decontamination procedures shall be followed unless modified by a site specific variance.
- B. First Cleaning:
 - 1. All bagged asbestos waste and unnecessary equipment shall be decontaminated and removed from the Work Area.
 - 2. All surfaces in the Work Area shall be wet cleaned. A wet-purpose shop vacuum may be used to pick up excess liquid, and may either be decontaminated prior to removal from the Work Area or disposed of as asbestos waste.
 - 3. The Asbestos Project Monitor shall conduct a visual inspection of the Work Area for cleanliness and completion of abatement.
 - 4. The Contractor shall then apply a thin coat of encapsulant to all surfaces in the Work Area that were not the subject of removal. In no event shall encapsulant be applied to any surface that was the subject of removal prior to obtaining satisfactory air monitoring results.
 - 5. After the encapsulant has dried, the first layer of polyethylene sheeting shall then be removed and bagged, and the Work Area shall be vacated for a minimum of 12 hours.
- C. Second Cleaning
 - 1. All surfaces in the Work Area shall be HEPA vacuumed and/or wet cleaned.
 - 2. The Asbestos Project Monitor shall conduct a second visual inspection of the Work Area for cleanliness.
 - 3. The second layer of polyethylene sheeting shall be removed and bagged and the Work Area shall be vacated for a minimum of 12 hours.
- D. Third Cleaning
 - 1. All surfaces in the Work Area shall be HEPA vacuumed and/or wet cleaned.
 - 2. The Asbestos Project Monitor shall conduct a third visual inspection of the Work Area for cleanliness.
 - 3. The Work Area shall be vacated for a minimum of 12 hours regardless of the cleaning method (HEPA vacuuming or wet cleaning) utilized.
 - 4. Aggressive final clearance air sampling shall then be conducted by the Environmental Consultant.
 - 5. Upon receipt of satisfactory final clearance air sampling results, the negative air pressure equipment can then be shut down and decontamination areas and isolation and critical barriers removed.

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- E. After isolation and critical barriers are removed, the Asbestos Project Monitor shall inspect the Work Area for cleanliness. If necessary, additional cleaning shall be performed by the Contractor as directed by the Asbestos Project Monitor.
- F. As a result of any visual inspection by the Asbestos Project Monitor or should air sampling results indicate high fiber levels; the Contractor will clean or re-clean the affected areas at no additional expense to the Owner.

3.11 ROOF REMOVALS

- A. Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Refer to Division 07 Sections for new roofing requirements.
- B. Except as modified by this section, removal of built-up roofing, roof flashings and flashing cement shall conform to all provisions of this specification.
- C. Unless Project specific variances have been otherwise obtained, roofing removals shall be conducted in accordance with the provisions of NYS DOL ICR-56.
- D. The Work Area shall be the roof area from which ACM materials are being removed and shall extend 25 feet from the perimeter of the removal area.
- E. Non-certified Workers are not allowed in the Work Area until the Work Area is cleared by the Asbestos Project Monitor.
- F. Remote personnel and waste decontamination enclosures shall be constructed at a location in accordance with the approved Work Plan. Unless located outside the Work Area, decontamination enclosures are not permitted to be constructed on the roof. Decontamination enclosures shall be stationary and located within 50 feet of the building.
- G. All openings (including but not limited to windows, doors, hatches, vents, ducts, and grilles) on the roof level and the floor below shall be sealed with two layers of six mil polyethylene. Alternately, a polyethylene drape may be used instead of sealing windows individually.
- H. The removal of the ACM may require the use of scrapers, solvents, mastic removal chemicals, or other methods/procedures to ensure complete removal.
- I. The Contractor is required to provide temporary protection of the roof at the end of each Work shift so as to maintain the roof in a watertight condition.
- J. Dumpsters used for waste storage shall be lined with two layers of six mil polyethylene and shall have a hard top. Where open-top dumpsters are permitted, the top shall be closed with polyethylene flaps that are sealed at the end of each work shift.
- K. Personal protective equipment, including respirators, shall be utilized and worn during all removal operations until the Work Area is cleared by the Asbestos Project Monitor.
- L. The Owner may, at his discretion, choose to conduct air sampling. If air samples collected during abatement indicate any airborne asbestos fiber concentration(s) at or above 0.01 f/cc, Work shall be stopped immediately and Work methods shall be altered to reduce the airborne asbestos fiber concentration(s).

PART 4 - DISPOSAL OF ASBESTOS WASTE

4.1 APPLICABLE REGULATIONS

- A. All asbestos waste shall be stored, transported and disposed of in accordance with the following regulations as a minimum:
1. NYS DEC 6 NYRCC part 360 and 364
 2. US EPA NESHAPS 40 CFR 61
 3. US EPA Asbestos Waste Management Guidance EPA/530-SW85
 4. NYC Local Law 70/85 (for Projects located in New York City).

4.2 TRANSPORTATION AND DISPOSAL SITE

- A. The Contractor's Hauler and Disposal Site shall be approved by the Owner.
- B. The Contractor shall give twenty-four (24) hour notification prior to removing any waste from the site. Waste shall be removed from the site only during normal working hours unless otherwise specified. No waste may be taken from the site unless the Contractor and Environmental Consultant are present and the Environmental Consultant authorizes the release of the waste as described herein.
- C. The Contractor shall have the Hauler provide the estimated date and time of arrival at the Disposal Site.
- D. Upon arrival at the Project Site, the Hauler must possess and present to the Environmental Consultant a valid New York State Department of Environmental Conservation Part 364 Asbestos Hauler's Permit. The Environmental Consultant may verify the authenticity of the hauler's permit with the proper authority.
- E. The Hauler, with the Contractor and the Environmental Consultant, shall inspect all material in the transport container prior to taking possession and signing the Asbestos Waste Manifests.
- F. Unless specifically approved by the Owner, the Contractor shall not permit any off-site transfers of the waste or allow the waste to be transported or combined with any other off-site asbestos material. The Hauler must travel directly to the disposal site as identified on the notifications with no unauthorized stops.

4.3 WASTE STORAGE CONTAINERS

- A. All waste containers shall be fully enclosed and lockable (i.e. enclosed dumpster, trailer, etc.). No open containers will be permitted on-site (i.e. open dumpster with canvas cover, etc.) unless specifically permitted by an applicable or site specific variance.
- B. The Environmental Consultant shall verify that the waste storage container and/or truck tags (license plates) match that listed on the New York State Department of Environmental Conservation Part 364 permit. Any container not listed on the permit shall be removed from the site immediately.
- C. The container shall be plasticized and sealed with a minimum of one (1) layer of 6 mil polyethylene on the sides and two (2) layers of 6 mil polyethylene on the floor. Once on site, it shall be kept locked at all times, except during load out. The waste container shall not be used for storage of equipment or contractor supplies.
- D. While on-site, the container shall be labeled with EPA Danger signage:

DANGER
CONTAINS ASBESTOS FIBERS

TAS 25-9A, D215012

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AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

- E. The New York State Department of Environmental Conservation Asbestos Hauler's Permit number shall be stenciled on both sides and back of the container.
- F. The container is not permitted to be loaded unless it is properly plasticized, has the appropriate danger signage affixed, and has the permit number appropriately stenciled on the container.
- G. If a lined and sealed open-top container is used pursuant to a site specific variance, a seal is not required.
- H. The Owner may initiate random checks at the Disposal Site to insure that the procedures outlined herein are complied with.

4.4 OWNER'S AND HAULER'S ASBESTOS WASTE MANIFESTS

- A. An Asbestos Waste Manifest shall be utilized in conjunction with the Asbestos Hauler's Manifest.
- B. The Hauler's Manifest shall be completed by the Contractor and verified by the Environmental Consultant that all the information and amounts are accurate and the proper signatures are in place.
- C. The Manifests shall have the appropriate signatures of the Environmental Consultant, the Contractor, and the Hauler representatives prior to any waste being removed from the site.
- D. Copies of the completed Hauler's Manifest shall be retained by the Environmental Consultant and the Contractor and shall remain on site for inspection.
- E. Upon arrival at the Disposal Site, the Hauler's Manifest shall be signed by the Disposal Facility operator to certify receipt of ACM covered by the manifest.
- F. The Disposal Facility operator shall return the original Hauler's Manifest and the container seals to the Contractor.
- G. The Contractor shall forward copies of the Hauler's Manifest and the container seals to the Environmental Consultant within 14 days of the waste container being removed from the site. Failure to do so may result in payment being withheld from the Contractor.
- H. The Contractor shall utilize a Waste Disposal Log. This log shall be maintained by the Project Supervisor and shall be kept on site at all times.
- I. Originals of all waste disposal manifests, seals, and disposal logs shall be submitted by the Contractor to the Owner with the final close-out documentation.
- J. Clean adjacent structures and improvements of dust, dirt, and debris caused by ACM demolition operations in accordance with Regulatory Requirements. Return adjacent areas to condition existing before ACM demolition operations began.

END OF SECTION 028213

ITEM 627.0003 25**CONCRETE****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.
- 1.02 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0003 25**CONCRETE****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

- A. Section 030130 CONCRETE DECK REPAIR
- B. Section 031119 PERMANENT FORMS – ICF
- C. Section 033000 CAST-IN-PLACE CONCRETE

1.02 This item shall include, but not be limited to, the following:

- A. Repairing existing damaged concrete surfaces
- B. Detailing insulating concrete forms (ICFs) and cast-in-place concrete

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SECTION 030130 - CONCRETE DECK REPAIR

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. All work shall conform to the latest industry practices and standards as applicable. Install all materials as per manufacturer's instructions.
- B. All work shall be performed by competent workmen trained and experienced in the particular type of work.
- C. Coordinate the work of this Section with other related Sections / Divisions.

1.2 SCOPE OF WORK

- A. The scope of work of this section includes repairing existing damaged concrete surfaces at roof deck at locations indicated on drawings and as directed by Authority's Representative. Work shall include but not necessarily limited to the following:
 - 1. Sounding of exposed concrete including cutting, chipping, and removing of deteriorated and unsound concrete.
 - 2. Proper surface preparation of the affected area in accordance with the instructions of the manufacturer of the repair material and as described in this section.
 - 3. Preparation of concrete surfaces and application of repair mortar in accordance with the instructions of the manufacturer of the repair material.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical bulletins and MSDS on each product.
- B. Quality Control Submittals: Provide protection plan of surrounding areas and non- cementitious surfaces.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications: Company with minimum 10 years of experience in manufacturing of specified products and systems.
 - 2. Applicator Qualifications: Company with a minimum of 5 years' experience in application of specified products and systems on projects of similar size and scope, and is acceptable to product manufacturer.
- B. Mock-ups and testing concrete repairs:
 - 1. Furnish, build, and have tested a mock-up containing the contractor's proposed repair materials. A representative from the accepted repair material manufacturer shall be at the site during the placement of the repair material and the testing. Construct mock-up for Authority's Representative visual examination, for quality control, and performance of required testing.

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2. Tests shall be conducted by an Independent Testing laboratory, as accepted by Authority's Representative.
3. Mock-up shall be constructed for patched repair at main roof decks, bulkhead roof decks, roof canopies and were directed by Authority's Representative.
 - a. Install at Project site or pre-selected area of building an area for mock-up as directed by Authority's Representative.
 - b. Apply material in strict accordance with manufacturer's written application instructions.
 - c. Manufacturer's representative or designated representative will review technical aspects, surface preparation, repair, and workmanship.
 - d. Mock-up will be standard for judging workmanship on remainder of Project.
 - e. Maintain mock-up during construction for workmanship comparison.
 - f. Do not alter, move, or destroy mock-up until Work is completed and approved by Authority's Representative.
 - g. Obtain Authority's Representative's written approval of mock-up before start of material application, including approval of aesthetics, color, texture, and appearance.
- C. Mock-up for patches shall be cured in accordance with manufacturer's recommendations. All mock-ups shall be tested for bond strength with the direct tension pull-off apparatus; "Bond Test" manufactured by German Instruments, Inc., Chicago, Illinois or equal.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements:
 1. Ensure that substrate surface and ambient air temperature are minimum of 45 degrees F and rising at application time and remain above 45 degrees F for at least 24 hours after application. Ensure that frost or frozen surfaces are thawed and dry.
 2. Do not apply material if snow, rain, fog, and mist are anticipated within 12 hours after application. Allow surfaces to attain temperature and conditions specified before proceeding with underlayment application.
 3. Do not apply over sealant joints, control joints, or other materials that will be affected by solvent.

1.7 DEFICIENT WORK

- A. Where Work exhibits any one or more of the following deficiencies, or otherwise fails to conform to the Contract Documents and/or the Building Code, such Work shall be considered deficient

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and not in conformance with the requirements of the Contract:

1. Applied grout mix not as defined by this Specification.
 2. Spalling, honeycombing, and the like.
 3. Unauthorized cutting, chopping, construction joints, cold joints, and so forth.
 4. Workmanship not in accord with the Drawings, with this Specification, with accepted samples, or with referenced codes or standards.
 5. Improper surface preparation.
 6. Incorrect forming, cracking, surface defects, or improper consolidation.
 7. Excellence of tolerance, lack of alignment, and incorrect forming; and
 8. Evidence of freezing, improper curing and the like.
 9. Evidence of patching material failure.
- B. Where Authority's Representative, at his/her sole discretion, finds any of the above deficiencies or other work not in accord with the Drawings or with this Specification, Authority's Representative may order that the affected work be replaced or repaired at Contractor's expense. Further, contractor shall pay the fees of Testing Agency for the re-inspection and the re-testing of Work deemed defective by Authority's Representative.
- C. The cost of all other activities and procedures associated with defective Work shall be paid by Contractor.

PART 2 - PRODUCTS

2.1 APPLICATIONS/ SYSTEM

- A. Repairing Damaged Reinforced Structural Members:
1. Anti-corrosion cementitious coating for re-bars shall be epoxy modified cementitious products specifically formulated as a bonding agent and anti-corrosion coating. Bond strength (ASTM C882) shall be 2600 psi after 24 hours open time. Acceptable products:
 - Sika Armatex 110 Epocem. Sika Corporation, Lyndhurst, NJ, (800) 933- 7452.
 - EMACO P24 or Thoroc Rebar Primer 3 by BASF. Phone: 800-433-9517
 - or equal.
 2. Bonding agent to bond new patch material to old concrete:
 - Euco Epoxy 452 LV, Euclid Chemical Company, Cleveland, Ohio (216) 531-9222.
 - Sikadur 32 HI-Mod, Sika Corporation, Lyndhurst, New Jersey, (800) 933-7452.
 - or equal.
 3. Overhead and vertical repairs: polymer modified cementitious mortar shall be fast setting, non-sag and trowel grade. Acceptable polymer modified cementitious mortars:
 - Sonopatch by BASF. Phone: 800-433-9517
 - ThoRoc HB2 Repair Mortar by BASF. Phone: 800-433-9517
 - Emaco R320 by BASF. Phone: 800-433-9517
 - or equal.
- B. Pins to be used in concrete surface repair shall be zinc coated ¼" dia x 3" long Hammer Drive Pins as manufactured by Power Fasteners Co. or equal. Length of pin shall be altered based on field condition.
- C. Hexagonal wire mesh shall be Stainless Steel wire mesh, 1" aperture and 23 gage as manufactured by Hebei FangZheng Wire Mesh Co. Ltd or equal.

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- D. Curing compound shall be according to ACI 308 Standard Practice or Compliant with ASTM C309.
- E. Hooks to be ¼" dia. threaded stainless steel rods, 9" o.c. maximum set in epoxy adhesive.
- F. A minimum of ¾" cover shall be in place for all existing and new steel reinforcement.
- G. Substitutions: Products of equal quality and properties.
- H. Other manufacturers shall comply with minimum levels of material, color selection, and detailing indicated in Specifications or on Drawings. Authority's Representative will be sole judge of appropriateness of substitutions.

PART 3 - EXECUTION

3.1 REPAIRS OF DETERIORATED CONCRETE AT ROOF DECK

- A. Surface Preparation
 - 1. Protect adjacent Work areas and finish surfaces from damage during complete system application.
 - 2. Ensure area being repaired is structurally sound and fully cured.
 - 3. All repair procedures and work required to repair deteriorated concrete shall be included as part of this contract.
- B. Concrete Preparation:
 - 1. First complete asbestos abatement; where applicable, as per applicable Sections of Division 2.
 - 2. Authority's Representative will tap affected vertical face of slabs and shall mark hollow sounding deteriorated spalled or pre-spalled areas.
 - 3. Contractor shall mark a second line, outside, rectangular and not closer than 3" to first line. Saw cut ½" deep with a diamond saw equipped with HEPA vacuum dust collector along second line. Do not cut any reinforcing bars. Saw cut edges of repair areas to minimum depth of ½ inch to avoid featheredging and to provide square edge.
 - 4. All concrete shall be removed from within the marked boundary to a minimum depth of ¾ inch using chipping hammers equipped with chisel point bits. If delaminating exists beyond the minimum removal depth, then chipping shall continue until all unsound and delaminated concrete has been removed from the cavity.
 - 5. Where embedded reinforcement is exposed by concrete removal, extra caution shall be exercised to avoid damaging the reinforcement during removal of additional unsound concrete. If bond between exposed embedded reinforcement and adjacent concrete is impaired by the Contractor's removal operations, then the contractor shall perform additional removal to sound concrete at no additional cost.
 - 6. If rust layers are present on embedded reinforcement or steel shapes/anchors where it enters sound concrete, then additional removal of concrete along and beneath the reinforcement shall be done.
 - 7. After removals are complete, but prior to final cleaning, the cavity and all exposed reinforcement shall be inspected by Authority's Representative for compliance with the requirement of this section. Where Authority's Representative finds unsatisfactory cavity preparation, Authority's Representative shall re-inspect the areas after additional cavity

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preparation.

8. Authority's Representative shall inspect all embedded reinforcement, within the cavity for defect due to corrosion or damage resulting from Contractor's removal operations. The assisting re-bars shall be provided to damage or defective bars as shown in the attached drawing details and as described below.

C. Reinforcement, pins, and hooks in repair areas:

1. All embedded reinforcement exposed during deteriorated concrete removal that has lost the area as specified in the drawings and as determined by Authority's Representative, shall be considered defective. All non-defective exposed reinforcement that has lost section to the extent specified above as a direct result of contractor's removal operations shall be considered damaged.
2. Supplement defective or damaged embedded reinforcement in accordance with the typical repair details shown on the drawings. Secure the new reinforcement to existing bars by wires or as directed by Authority's Representative.
3. Loose reinforcement exposed during surface preparation shall be securely anchored with hooks to secure reinforcing prior to patch placement. This work is incidental to surface preparation and shall be included in the established unit price for the type of repair specified.
4. Concrete shall be removed to provide a minimum of 1/2-inch clearance on all sides of reinforcement that is in place. A minimum of 3/4 inch concrete cover shall be provided over all new and existing reinforcement.
5. All reinforcing steel that supplements defective or damaged reinforcing steel shall be installed with a minimum clear cover of 3/4 inches to repaired concrete surfaces and shall be prepared as required to meet the minimum clearance requirement and to match adjacent concrete surfaces.
6. All exposed steel shall be cleaned of rust and laitance to bare metal by vacuum blasting in accordance with SSPC-SP6 "Commercial Blast Cleaning".
7. Install stainless steel Hammer Drive pins and wire mesh at all repairs. Hammer Drive pins shall be installed using Hammer Drive Tool and by applying several sharp hammer blows to the tool. Minimum embedment shall be 1/2" in hard concrete. Use two pound hammer for maximum penetration using the fewest hammer blows. The spacing between pins shall be 12" o.c. and 4" from the edge of the cavity.
8. Install stainless steel hooks with epoxy adhesive at repair area to secure existing reinforcing in place. Drill into sound substrate. Fill the hole with instantly mixed epoxy material using dispensing equipment and immediately install the hooks.

D. Final preparation of cavity for repair:

1. Cavities shall be examined by the Authority's Representative prior to commencement of patching repair operations. Where Authority's Representative finds unsatisfactory cavity preparation, Authority's Representative shall direct the Contractor to perform additional work to obtain satisfactory cavity preparation.
2. Cavities shall be completely power wire brushed with attached vacuum. Where power wire brush could not be performed, power wash shall be carried out. Pressure vacuuming cleaning with compressed air is required as a final step to remove dust and loose material. All debris shall be removed from the site prior to commencement of patching. Install stainless steel hooks 6" o.c. and assisting bars as determined by the Authority's Representative prior to patching.
3. Cavities not inspected by the Authority's Representative prior to patch repair will be considered non-conforming and will be rejected. Repair material shall be removed,

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substrate shall be re-cleaned and repair material shall be reinstalled at no additional cost.

4. Chipping hammer size shall be suitable to perform the required work without causing damage to structure.
5. Clean surface by removing dust, unsound or contaminated material, oil, paint, greases, corrosion deposits, and all bond-inhibiting materials from surface.
6. Contractor shall provide the means for dust and debris control.
7. Do not use method of surface preparation that could damage concrete.
8. Where breaking out is not required, roughen surface and remove laitance by mechanical means or high-pressure water wash. Remove oil and grease deposits by steam cleaning, detergent scrubbing, or degreasing. To ensure optimum results, test effectiveness of decontamination with pull-off test.
9. Saturate surface with clean water. Surface should be saturated surface dry (SSD) with no standing water during application.
10. For additional information on substrate preparation, refer to ICRI Guideline No. 03732 "Coatings and Polymer Overlays".
11. Avoid contact with aluminum to prevent adverse chemical reaction and possible product failure. Insulate potential areas of contact by coating aluminum substrate with appropriate epoxy such as Sikadur Hi-Mod 32.

E. Steel Preparation:

1. Remove oxidation and scale from exposed reinforcing steel per ICRI Technical Guideline No. 03730 "Guide to Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion."
2. To prevent future steel corrosion, coat prepared reinforcing steel with approved anticorrosion cementitious coating.

F. Application of Repair Mortar

1. Ensure substrate is Saturated Surface-Dry (SSD).
2. Using manufacturer's approved applicator, scrub thin coat thoroughly into surface to ensure sufficient bonding.
3. Before bond coat dries, thoroughly compact repair mortar onto substrate and around exposed reinforcement.
4. Install pins and wire mesh into repair mortar as per manufacturer's recommendations.
5. Scrub repair mortar into the substrate, filling all pores and voids. Force material against edge of repair, working towards center.
6. Where multiple lifts are used on repairs, lightly rake surface of initial application after initial set and before applying subsequent lifts. Allow preceding lift to reach final set, 30 minutes minimum. Before applying fresh material, saturate surface of lift with clean water.
7. If material sags during application, completely remove repair mortar, properly re-prime substrate, and reapply repair mortar at reduced thickness.
8. Finish repair mortar by striking off with straight edge and close with steel trowel. Wooden or plastic floats or sponges may also be used to achieve desired surface texture. Do not overwork completed surface.
9. Final finish surface shall match adjoining surface in texture, alignment, and flatness.

3.2 CURING

- A. Allow proper curing of patch repair mortar, conducted per ACI 308 "Standard Practice for Curing Concrete." Moist curing should commence immediately after finishing.

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- B. Where ambient conditions (high temperature, low humidity, or moderate to high winds) may cause rapid moisture loss, use an ASTM C309-compliant compatible curing compound, sprayed onto surface of finished repair in continuous film. Curing compounds adversely affect the adhesion of following lifts of mortar or protective coating, pretesting of curing compound is recommended by the manufacturer. Do not use solvent based curing compound.

3.3 CLEANING

- A. Clean wet repair mortar material from tools and equipment with water. Remove cured materials mechanically.
- B. Clean up and properly dispose of debris remaining on Project site related to application.
- C. Remove temporary coverings and protection from adjacent Work areas.
- D. In case of spillage, scoop or vacuum into appropriate container, and dispose of in accordance with current applicable local, state, and federal regulations.

3.4 PROTECTION

- A. Protect repair mortar system and protective coating from damage during construction.
- B. Protect repair mortar system and protective coating from freezing for 24 hours after application.
- C. Protect surface prior to installation of finish topping from damage by use of plywood or other suitable protection course until Substantial Completion.

END OF SECTION 030130

SECTION 031119
PERMANENT FORMS—INSULATING CONCRETE FORMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Supply and installation of permanent insulating concrete forms as formwork, placement of steel reinforcement and placement of concrete into formwork.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C 578 -- Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation (ASTM C203, ASTM C303, ASTM C518, ASTM C272, ASTM D1621, ASTM D2126, ASTM D2863, ASTM E84, ASTM E96)
 - 2. ASTM C 236 -- Steady State Thermal Performance of Building Assemblies
 - 3. ASTM C 150 -- Standard Specification for Portland Cement Types I, II, III.
 - 4. ASTM D 1761 -- Standard Test Methods for Mechanical Fasteners in Wood
 - 5. ASTM E 84 -- Standard Test Method for Determining Surface Burning Characteristics of Building Materials
 - 7. ASTM A 615 -- Steel Specifications for Steel Reinforcement
 - 8. ASTM D 1929 -- Standard Test Method for Determining Ignition Properties of Plastics
 - 9. ASTM D 635 -- Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
 - 10. ASTM D 2843 -- Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics
 - 11. ASTM E 119 -- Fire Tests of Building Construction and Materials
 - 12. ASTM D 638 -- Standard Test Method for Tensile Properties of Plastics
 - 13. ASTM D732 -- Shear Strength of Plastics by Punch Tool
 - 14. ASTM E 90 -- Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
 - 15. ASTM E2634 -- Standard Specification for Flat Wall Insulating Concrete Form Systems
- B. American Concrete Association
 - 1. ACI 301 -- Standard Specification for Structural Concrete
 - 2. ACI 304 -- Guide for Measuring, Mixing, Transporting and Placing Concrete
 - 3. ACI 305 -- Hot Weather Concreting
 - 4. ACI 306 -- Cold Weather Concreting
 - 5. ACI 309 -- Guide for Consolidation of Concrete
 - 6. ACI 318 -- Building Code Requirements for Reinforced Concrete
 - 7. ACI 332 -- Guide to Residential Cast-In-Place Concrete Construction
 - 8. ACI 347 -- Guide to Formwork for Concrete
 - 9. ACI 560 -- Design and Construction with Insulating Concrete Forms
- C. International Code Council Evaluation Service, Inc. (ICC-ES)
 - 1. AC 353 -- Acceptance Criteria for Stay-In-Place, Foam Plastic Insulating Concrete Forms
- D. Canadian Standards Association (CSA)
 - 1. CAN/CSA A23.3 Design of Concrete Structures
- E. Underwriters Laboratory of Canada
 - 1. CAN/ULC S701- Thermal Insulation, Polystyrene, Boards and Pipe Covering

2. CAN/ULC S102- Test for Surface Burning Characteristics of Building Materials and Assemblies
3. CAN/ULC S101- Fire Endurance Tests of Building Construction and Materials
4. CAN/ULC S717.1 – Standard for Flat Wall Insulating Concrete Form (ICF) Systems

1.3 SYSTEM DESCRIPTION - (ICF) Systems for Solid Concrete Walls

- A. Provide insulating concrete form product which has been manufactured and installed to withstand concrete placement loads without defects, damage, or failure and such that the cast-in-place concrete wall is designed according to ACI 318 “Building Code Requirements for Reinforced Concrete.” OR CAN/CSA A23.3 Design of Concrete Structures.
- B. Furnish labor, materials, equipment, and services necessary for the complete and proper installation of all insulating concrete framework and related work, as shown on the drawings or specified herein, in accordance with all applicable requirements of the contract documents.
 1. Insulating concrete wall formwork consisting of two flat wall panels of flame retardant Type II expanded polystyrene (EPS) manufactured to a 1.5 lbs/cu. ft. minimum density. The two EPS panels to be connected by 6 co-polymer polypropylene plastic tie inserts designed with cross members placed 8” o.c. horizontally and 8” o.c. vertically creating a symmetrical design enhancing installation efficiency and reducing product waste. Plastic tie inserts positioned perpendicular between the EPS panels. The ICF product to be modular or prefabricated factory assembled forms.
 2. The ICF formwork to have consistent 2 5/8” thick EPS panels with a single row of rectangular interlocking projections and recesses designed for efficient installation with the modular ICF formwork having no top, bottom, left or right sides; which is a universal type of design. Straight and specialty blocks (90-degree corner, 45-degree corner, etc.) all possess the same design features and characteristics.
 3. Plastic tie inserts designed to allow for additional reinforcement placement positions to comply with structural design. The rebar chair supports are two deep with a loose fit for contact splice connections.
 4. Wall system to provide a forming cavity width of a minimum 4”, 6”, 8”, 10” or 12” (as design requires). The cavity width shall be a consistent flat rectangular cross section for the full and half blocks.
 5. Wall system plastic tie inserts to provide minimum 1.5” wide and 0.23” thick
 6. fastening strips @ 8” o.c. fastening strips to be recessed beneath the EPS panel face 5/8” and run vertically full form height (16” for the standard Fox Block and 8” for the shorter Fox Half Block) to facilitate fastening both interior and exterior.
 7. Wall system consisting of two EPS panels, concrete and exterior and interior finishes to provide a minimum R22 insulation value.
 8. EPS foam to provide maximum vapor permeation of 3.5 Perm-in.
- C. Conform to the applicable building code requirements of regulatory agencies having jurisdiction.

1.4 SUBMITTALS

- A. All submittals, which do not conform to the following requirements, will not be acceptable:
- B. SUBMITTALS OF EQUALS. Submit insulating concrete form system to be considered as equal to the specified insulating concrete form system submitted and approved prior to

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bid date. Insulating concrete form system, which has been reviewed and accepted as equal to the specified form system, will be listed in an addendum prior to bid date; only then will equals be accepted at bidding. Submittals shall include the following;

1. A sample ICF formwork product to meet or exceed 1.4 System Description.
 2. Current edition of the insulating concrete form system manufacturer's specifications and installation guidelines.
 3. Documentation of the manufacturer's quality control/quality assurance program for the primary insulating concrete form product supplied.
 4. Descriptive list of the materials proposed for use.
 5. ICF manufactured product has been evaluated for current compliance with the applicable building code evaluation service.
 6. Documentation of fastener withdrawal from plastic tie insert flange strip.
 7. Documentation of fire rating design listings where applicable.
 8. Documentation of non-combustible construction approval where applicable.
 9. Letter from the proposed insulating concrete form system confirming that proposed insulating concrete form manufacturer had been producing ICF products in North America for a minimum of 5 years.
 10. Confirmation of third party Quality inspection of manufacturing location by either letter from an accredited third part inspection agency or submission of Quality Control Manual meeting ICC-ES requirements.
- C. SUBMITTALS PRIOR TO CONTRACT AWARD:
1. Proposed insulating concrete form manufacturer to submit product warranty prior to contract award.
- D. SUBMITTALS PRIOR TO COMMENCEMENT OF ICF WORK:
1. Designer's printed recommendations for the proper installation of mechanical and electrical component installations, penetrations, interior and exterior finishes and attachment of structural elements.

1.5 QUALITY ASSURANCE

- A. ACCEPTABLE PRODUCTS AND MANUFACTURER'S QUALIFICATIONS. A single manufacturer that has been continuously producing ICF products for not less than 5 years in North America.
- B. AGENCY APPROVALS. The proposed insulating concrete form product shall have been evaluated to the applicable building code and shown to be in current compliance as evidenced by an evaluation report and/or certification to a standard from one of the following code agencies.
 1. ASTM E2634
 2. CAN/ULC S717.1
- C. Accredited third-party independent testing and current reporting.
- D. SCOPE OF WORK. The work to be performed under this specification shall include but is not limited to the following: Attend necessary job meetings and furnish competent and full time supervisor, labor, all materials, tools, and equipment necessary to complete, in an acceptable manner, the insulating concrete form system installation in accordance with this specification. Comply with the application guidelines of the manufacturer of the insulating concrete form products.
- E. CONFERENCES: Subject to Architect's discretion.

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1. PRELIMINARY CONFERENCE: As soon as possible after award of insulating concrete formwork, meet with the contractor, sub-contractors and other workers related with the installation of the insulating concrete form system including penetrating work and finish systems, architect, engineer, owner and representatives of other entities directly concerned with performance of the insulating concrete form system. Review requirements (Contract Documents), submittals, status of coordinating work, availability of materials, and installation facilities and establish preliminary installation schedule. Review requirements for inspections, testing, certifications, and forecaster weather conditions, governing regulations, insurance requirements and proposed installation procedure.
2. PRE-APPLICATION INSULATING CONCRETE FORM CONFERENCE:
 - a. Approximately 2-3 weeks before scheduled commencement of insulating concrete form installation and associated work, meet at project site with contractor, sub-contractors, concrete supplier and other related work that must precede or follow formwork including architect, owner, insulating concrete form manufacturer's representative and other representatives directly concerned with performance of the work.
 - 1) Review methods and procedures related to insulating concrete formwork, including but not necessarily limited to the following:
 - 2) Verify that site conditions are as set out in Division 1 – General Requirements. Insulating concrete form installer is to coordinate provision of access, storage area and protection of ICF product.
 - 3) Verify footing installation conforms to requirements of 1/4" within level and that steps or elevation changes in footings are in 8" or 16" height increments.
 - 4) Verify that reinforcing steel dowels are in place at specified centers along footing lengths.
 - 5) Review transitions, special penetration details, area drainage, curbs, proposed openings, structural elements (lintels and bucks) and conditions of other construction that will affect insulating concrete forms.
 - 6) Review insulating concrete form requirements (drawings, specifications, and other contract documents).
 - 7) Review required submittals, both completed and yet to be completed.
 - 8) Review and finalize construction schedule related to insulating concrete formwork and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - 9) Review temporary protection requirements for insulating concrete form system during and after installation.
 - 10) Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in original factory packaging, bearing listing and leveling identification of product, manufacturer and lot number. Installer to keep the labels for traceability of product for the duration of the contract.
- B. Handle and store products in a location to prevent damage and soiling.
- C. Ensure that UV protection is provided for material, on-site storage should be required for an extended time period.

1.7 PROJECT CONDITIONS

- A. Use appropriate measures for protection when required to ensure proper concrete curing conditions in accordance with ACI 305 and ACI 306 during periods of weather where temperatures are above or below minimum specified by the governing or local building code for concrete.
- B. Familiarize every member of the application crew with all applicable safety regulations recommended by OSHA and other industry or local governmental groups.

1.8 SEQUENCING AND SCHEDULING

- A. Sequence installation of insulating concrete forms with related work specified in other sections to ensure that wall assemblies, including window and door accessories, trim, service penetrations, transition changes and mechanical services are protected against damage from effects of weather, corrosion and adjacent construction activity.

1.9 PRODUCTS INSTALLED BUT NOT SPECIFIED OR SUPPLIED UNDER THIS SECTION

- A. Reinforcing Steel
- B. Concrete
- C. Anchor bolts, sleeves, embedments, and inserts
- D. Window and door bucks
- E. Dampproofing, waterproofing, or parge coat
- F. Adequate bracing and scaffolding that meets the codes

1.10 WARRANTY

- A. Insulating concrete form manufacturer to provide copies of specified product warranties.

PART 2 - PRODUCTS

2.1 MANUFACTURER -- INSULATING CONCRETE FORM PRODUCTS

Fox Blocks
6110 Abbott Drive
Omaha, NE 68110
www.foxblocks.com (877-369-2562)

Fox Blocks Technical Information and Training Guide is attached to this Section for Contractor's reference.

2.2 MATERIALS -- INSULATING CONCRETE FORM GENERAL CHARACTERISTICS: Form units with the following characteristics and dimensions to accommodate project criteria:

- A. Fox Blocks – pre-assembled modular block

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- B. Fox Blocks Compact – field assembled block
- C. Fox Blocks Reveal – one-sided foam insulation block
- D. Expanded polystyrene (EPS) plastic foam units, each panel 2 5/8” thick.
- E. Full height web flanges 8 inches on center for fastening tested to ASTM D1761 and made from recycled polypropylene plastic
- F. Nominal 1.5 lbs./cu. ft. foam density.
- G. Form system to have smooth wall face on the interior cavity

2.3 BRACING, ALIGNMENT AND SCAFFOLD SYSTEM

- A. As an integral installation component of an insulating concrete form system, an adjustable metal scaffolding support and wall alignment system shall be provided.
- B. A device with adequate degrees of adjustment to ensure the completed insulating concrete form system walls are plumb after the placement and consolidation of concrete.
- C. An OSHA compliant scaffold support system to facilitate proper stacking of forms and placement of concrete and to handle all design construction loads.
- D. System adequate to reinforce and protect completed insulating concrete form installation prior to the attachment of structural elements to protect from wind damage.

2.4 CONCRETE

- A. Concrete supplied under Section 033000 shall be of strength as specified by the design engineer (measured at 28 days). The recommended aggregate size is 3/8” minimum and 3/4” maximum. Minimum compressive strength recommended is 3000 psi for the walls and 2500 psi for footing foundations per Engineer of Record.
- B. Recommended concrete slump is 5” to 7” and designed to be placed with a concrete pump.
- C. Perform the required concrete consolidation per ACI 304 and ACI 309 to be manufactured as specified or detailed by the structural engineer in conjunction with the insulating concrete form manufacturer’s installation manual guidelines.
- D. In extreme temperatures concrete shall be placed in accordance with ACI 305 Cold Weather Concrete Placement or ACI 306 Hot Weather Concrete Placement

2.5 STEEL REINFORCEMENT

- A. Steel reinforcement shall be as designated on Structural Drawings (S-Series drawings) and shall be supplied in accordance with the Drawings for placement by the insulating concrete form installer.
- B. Lintel Description
- C. Lintels to be installed as specified or detailed by the structural engineer in conjunction with the insulating concrete form manufacturer’s installation manual guidelines or per IRC/IBC or the NBC of Canada model codes. Size and placement of top and bottom reinforcing steel, stirrups for shear reinforcement and corner reinforcing to be verified with engineering design prior to concrete placement.
- D. xLerator Structural Steel reinforcement for the Corbel Ledge Form.

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- E. Reinforcing steel stirrup to be placed in accordance with Structural Engineer's Specifications and details for the given project installation parameters.

2.6 PARGING

- A. Exposed exterior wall surface from 12 inches below grade to the bottom of the metal siding panels shall be covered with a durable, weather resistant covering. Product shall be a polymer-modified, fiber-reinforced, Portland cement based rigid coating formulated for use over EPS foam. Acceptable products include:
 - 1. Quikrete – “Foam Coating” (Product # 1219-81)

2.7 ACCESSORIES

- A. Window or Door Opening Buck Materials
 - 1. Extruded vinyl, wood, Fox Buck, or metal buck material.
- B. Steel Reinforcement for Corbel Ledge Form.
 - 1. xLerator – One-piece, one per form reinforcement supplied by Fox Blocks to be exclusively used in the Corbel Ledge Form

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Remove all loose aggregate and foreign substances prior to commencement of insulating concrete form system installation.

3.2 INSTALLATION OF FORMWORK UNITS

- A. Installation of forms to be in accordance with manufacturer's installation guidelines as submitted in evidence under Article 1.5.
- B. The installer shall ensure the following accepted ICF construction practices are utilized on site as outlined in the manufacturer's installation guidelines:
 - 1. Footing Foundation Construction
 - 2. Staging Materials
 - 3. Wall Layout
 - 4. Course Placement
 - 5. Horizontal Reinforcement Placement
 - 6. Door and Window Opening Construction (See 3.4 Below)
 - 7. Utility Service Penetration (See 3.3 Below)
 - 8. Bracing, Alignment and Scaffolding
 - 9. Vertical Reinforcement Placement
 - 10. Lintel Construction (see applicable code and/or engineering design)
 - 11. Checklist Prior to Concrete Placement
 - 12. Concrete Placement
 - 13. Placement Methods/Types (Pumping, etc.)
 - 14. Mix Design
 - 15. Concrete Consolidation Methods
 - 16. Post Placement Methods
 - 17. Below Grade Waterproofing Application
 - 18. Parging/Exterior Finishes

- 19. Clean-up (See 3.5 Below)
- 20. Protection (See 3.6 Below)
- 21. Drainage tile
- 22. Backfilling

3.3 SERVICE PENETRATIONS

- A. Service penetrations (electrical service conduits, water service pipes, air supply, exhaust ducts, etc.) shall be placed at the required locations as indicated by the appropriate trades.
- B. Penetrations shall be reinforced as required by the structural engineer.
- C. Provide and install material such as metal and PVC Schedule 40 pipe sleeves at service penetrations prior to placing concrete to create voids where services can be passed through at a later date.

3.4 ACCESSORY PRODUCT INSTALLATIONS

- A. Buck Material. Refer to the manufacturer's guidelines for installation of appropriate bucking materials.
- B. xLerator steel reinforcement for use in the corbel block to be installed as specified or detailed by the structural engineer in conjunction with the insulating concrete form manufacturer's installation manual guidelines.

3.5 CLEANUP

- A. Clean up and properly dispose of all debris remaining on job site related to the installation of the insulating concrete forms.

3.6 PROTECTION

- A. Consult with exterior finish contractor concerning exposure to ultraviolet light to ensure proper finish to ICF walls.
- B. Protect the interlocking teeth prior to concrete placement if additional forms are to be stacked after concrete placement.

END OF SECTION 031119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, finishes, and testing for the following:
1. Footings.
 2. Foundation walls.
 3. Slabs-on-grade.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with fly ash; subject to compliance with requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture, indicating quantity of each ingredient and admixtures proposed or required. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. For mix designs based on field experience, include individual strength test results, standard deviation, and required average compressive strength calculations.
 2. For mix designs based on trial, include proportions, test results, and graphic analysis indicating average compressive strength.
 3. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include 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.
- D. Schedule for Concrete Placement: Order-of-construction schedule by location in structure.
1. Include shop drawings indicating all construction joints required, including any anticipated joints due to placement schedule.
- E. Submit description of planned procedures and protective measures for cold weather or hot weather concreting.
- F. Qualification Data: For Installer.
- G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- H. Material Certificates: For each of the following, signed by manufacturers; indicate compatibility with application of surface applied flooring products where applicable:
1. Cementitious materials.
 2. Aggregates.
 3. Admixtures.
 4. Form materials and form-release agents.
 5. Steel reinforcement and accessories.
 6. Curing compounds.
 7. Bonding agents.

7. Adhesives.
 8. Vapor retarders.
 9. Joint-filler strips.
 10. Repair materials.
- I. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.
 - J. Field quality-control test and inspection reports.
 1. Include copies of delivery tickets complying with ASTM C 94 for each load of concrete delivered to the site.
 - K. Minutes of preinstallation conference.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 1. Comply with requirements of the Concrete Manufacturers Association "Concrete Plant Standards."
- C. 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.
- D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5, Section 7, "Lightweight Concrete", and Section 8.
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 3. ACI 305, "Hot Weather Concreting".
 4. ACI 306, "Cold Weather Concreting".
 5. ACI 308, "Guide to Curing Concrete".
 6. ACI 302, "Guide for Concrete Floor and Slab Construction".
 7. ACI 315 "Details and Detailing of Concrete Reinforcement."
 8. ACI 347 "Formwork for Concrete"; and
 9. Concrete Repair Manual, by ACI and ICRI.
- E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 2. Review the following:

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- a. Coordination with special inspection and testing and inspecting agency procedures for field quality control.
- b. Concrete finishes and finishing.
- c. Cold- and hot-weather concreting procedures.
- d. Curing procedures.
- e. Construction contraction and isolation joints and joint-filler strips.
- f. Forms and form removal limitations.
- g. Vapor-retarder installation.
- h. Anchor rod and anchorage device installation tolerances.
- i. Steel reinforcement installation.
- j. Floor and slab flatness and levelness measurement.
- k. Concrete repair procedures.
- l. Concrete protection.

J. The Contractor is responsible for correction of concrete work which does not conform to the specified requirements, including strength, tolerances, and finishes. The Contractor shall correct deficient concrete as directed by the Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - 1. Store steel reinforcement off ground, under suitable cover or enclosed.
 - 2. Maintain ease of access for inspection and identification of materials.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Metal or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

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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, Grade 60, deformed.
 1. Include supplementary requirement S1.
- B. Plain-Steel Wire: ASTM A 82, as drawn.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615, 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 where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 2. Supporting devices for slabs-on-grade shall have sand plates.
- C. Tie Wire: 16 gauge annealed type.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 1. Portland Cement: ASTM C 150, Type I or II. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F.
- B. Aggregates, General: Tested and passed within 6 months of use for the following:
 1. Gradation: ASTM C 136.
 2. Material Passing No. 200 Sieve: ASTM C 117.
 3. Organic Impurities: ASTM C 40.
 4. Soundness: ASTM C 88.
 5. Clay Lumps: ASTM C 142.
 6. Abrasiveness of Coarse Materials: ASTM C 131.
 7. Soft Particles: ASTM C 235.
 8. Freeze/Thaw Resistance: ASTM C 66, ASTM C 682.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 1. Maximum Coarse-Aggregate Size:
 - a. Percentage passing No. 200 sieve shall be less than 0.7%.
 - b. Nominal size 1 1/2": ASTM Size No. 467.
 - c. Nominal size 1": ASTM Size No. 57.
 - d. Nominal size 1/2": ASTM Size No. 7.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

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- a. Percentage passing No. 200 sieve shall be less than 3%.

D. Water: ASTM C 94 and potable.

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. Admixtures which result in more than 0.1% of soluble chloride ions by weight of cement are prohibited.

- 1. Water-Reducing Admixture: ASTM C 494, Type A.
- 2. Retarding Admixture: ASTM C 494, Type B.
- 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
- 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
- 6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494, Type C.

- 1. Products:
 - a. Euclid Chemical Company (The); Eucon CIA.
 - b. Grace Construction Products, W. R. Grace & Co.; DCI.
 - c. Master Builders, Inc.; MasterLife CI 30.
 - d. Sika Corporation; Sika BNI.

2.6 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A. Product shall have a permeance rating of 0.01 perms maximum. Include manufacturer's recommended adhesive or pressure-sensitive tape.

- 1. Products:
 - a. Fortifiber Corporation; Moistop Ultra A.
 - b. Raven Industries Inc.; Vapor Block 15.
 - c. Stego Industries, LLC; Stego Wrap, 15 mils.

B. Plastic Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

- 1. Products:
 - a. Fortifiber Corporation; Moistop Ultra.
 - b. Raven Industries Inc.; Vapor Block 15.
 - c. Stego Industries, LLC; Stego Wrap, 15 mils.

C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

D. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

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1. Products:
 - a. Burke by Edoco; BurkeFilm.
 - b. ChemMasters; Spray-Film.
 - c. Meadows, W. R., Inc.; Sealtight Evapre.
 - d. Sika Corporation, Inc.; SikaFilm.
 - e. Symons Corporation, a Dayton Superior Company; Finishing Aid.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
 1. Characteristics: Acrylic polymer blend; non-yellowing from ultraviolet exposure; dustproofs concrete.
 2. Products:
 - a. ChemMasters; Safe-Cure Clear.
 - b. MBT Protection and Repair, Div. of ChemRex; MasterKure-N-Seal VOC.
 - c. Meadows, W. R., Inc.; Vocomp-20.
 - d. Sonneborn, Div. of ChemRex; Kure-N-Seal.
 - e. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
 - f. Tamms Industries, Inc.; Clearseal WB STD.
- F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 1. Products:
 - a. Burke by Edoco; Cureseal 1315.
 - b. Euclid Chemical Company (The); Super Diamond Clear.
 - c. L&M Construction Chemicals, Inc.; Lumiseal Plus.
 - d. Meadows, W. R., Inc.; CS-309/30.
 - e. Sonneborn, Div. of ChemRex; Kure-N-Seal 5.
 - f. Tamms Industries, Inc.; LusterSeal 300.
- G. Evaporation Retarder:
 - Products:
 - a. BASF Construction Chemicals; Master Builders, Confilm.

2.8 RELATED MATERIALS

- A. Expansion-Joint-Filler and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber for pavements and sidewalks, and ASTM D 1752, cork or self-expanding cork for slabs-on-grade.
- B. Preformed Control Joint Former for joints to receive sealant or for sawcut type joints. To be used only with approval of the Architect.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Burlap: AASHTO M 182, Class 2 jute or kenaf cloth.

2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, on the basis of laboratory trial mixture or field test data, or both, according to ACI 301. Proportion design mixes per the recommendations of ACI 211.1 for normal weight concrete.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
 2. Design mixes to meet or exceed each requirement specified. Adjust mix design to meet the most stringent requirement.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 15 percent.
 2. Combined Fly Ash and Pozzolan: 15 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- 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.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 4. Use set-accelerating corrosion-inhibiting admixture in concrete mixtures where indicated.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings and Buried Foundations: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3,500 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio by Weight: 0.50.
 3. Minimum Cementitious Materials Content: 475 lb/cu. yd.
 4. Maximum Nominal Aggregate Size: 1 inch.
 5. Maximum Slump Limit: 3-1/2 inches, plus or minus 1 inch.
- B. Slabs-on-Grade (Interior): Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio by Weight: 0.45.
 3. Minimum Cementitious Materials Content: 540 lb/cu. yd.
 4. Maximum Nominal Aggregate Size: 1 inch.

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5. Maximum Slump Limit: 3-1/2 inches, plus or minus 1 inch.
- C. Exposed Foundation, Exterior Walks and Retaining Walls: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 5,000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio by Weight: 0.45.
 3. Minimum Cementitious Materials Content: 590 lb./cu.yd.
 4. Minimum Nominal Aggregate Size: 1/2 inch.
 5. Maximum Nominal Aggregate Size: 1-1/2 inches.
 6. Maximum Slump Limit: 3-1/2 inches, plus or minus 1 inch.
 7. Air Content: 5.5 percent, plus or minus 1.0 percent.
- D. Concrete Fill for Insulated Block Forms: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 3,000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio by Weight: 0.45.
 3. Minimum Cementitious Materials Content: 590 lb./cu.yd.
 4. Maximum Nominal Aggregate Size: 3/8 inch to 3/4" max.
 5. Maximum Slump Limit: 5-7 inches, plus or minus 1 inch.
 6. Air Content: 4 to 6 percent.
- E. Controlled Low Strength Material (CLSM)
 1. Permanent Material
 - a. Material shall meet the requirements of ACI 229R with a minimum compressive strength of 400 lb./sq. in.
 2. Removable Material
 - a. Material shall meet the requirements of ACI 229R with a minimum compressive strength of 50 to 100 lb./sq. in.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- B. Bend steel reinforcement in accordance with ACI 318.
 1. Do not heat steel reinforcement for bending. Bend or straighten bars cold.
 2. Do not bend partially embedded steel reinforcement, except as approved.

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, paragraphs 1 to 15 and 18 only, and furnish batch ticket information.
 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. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

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.

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- B. 1. Where elevated concrete thickness exceeds 8 inches, contractor to provide Design Plans and Calculations of formwork shoring and bracing for review.
- C. 2. Earth forms are not permitted.
- D. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- E. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 - 2. Class C, 1/2 inch for rough-formed finished surfaces.
- F. Construct forms tight enough to prevent loss of concrete mortar.
- G. 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, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- H. 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.
- I. 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.
- J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- M. 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." Misplaced or damaged anchor rods will be subject to re-engineering fees.
 - 2. Install dovetail anchor slots in concrete structures as indicated.
 - 3. Installed penetrating conduits and embedded pipes in concrete shall comply with Section 6.3 of ACI 318.
 - a. No conduits or embedded pipes shall be located within supported slabs or slab-on-grade.

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.

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1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 2. 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. Lap joints 6 inches and seal with manufacturer's recommended 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.
 2. Allow six hours between completion of reinforcement installation and placement of concrete for special inspection.
- B. Clean reinforcement of dirt, grease, scale, loose rust, oil, paint and other foreign matter prior to installation.
- 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. Splicing and Embedment of Reinforcement: Conform to ACI 318 Chapter 12 for wired lap splices and embedment lengths.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- G. 1. "Hooking-up" or "Walking-in" of any reinforcement will not be permitted.
- H. Maintain required concrete cover dimensions indicated. Coordinate placement of conduit and inserts with reinforcement. Protect installed reinforcement from damage or displacement prior to and during concrete placement.
- I. 1. The Contractor shall repair or replace damaged, distorted, or displaced reinforcement.

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.

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1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 3. Locate joints for beams, slabs, 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.
 7. Provide waterstops as indicated, and at all construction joints below grade adjacent to usable spaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness or a minimum of 1-inch as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
 3. Spacing of joints shall not exceed 30 times (24 times for exposed concrete floor surface) the thickness of the slab nor 15 feet on center. All panels should be square or nearly so. Joints shall typically isolate columns and run between columns, with intermediate joints located at equal spaces between column lines.
 4. Joints produced using conventional processes shall be made within 4 or 12 hours after the slab in that area has been finished- within 4 hours in hot weather and within 12 hours in cold weather.
 5. Joints produced using early-entry dry-cut saws shall be made within 1 or 4 hours after the slab in that area has been finished- within 1 hour in hot weather and within 4 hours in cold weather.
 6. Hand tooled joints shall be done immediately following edging, or at the same time.
 7. For floors to be covered with quarry tile, ceramic tile, or terrazzo, the joints shall be aligned with joints in the rigid floor coverings.
- D. Contraction Joints in Walls: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Provide adequate shear reinforcement as indicated or directed. Construct contraction joints as follows:
- E. 1. Joints shall be constructed to provide for the installation of watertight joint and sealant, and filled with sealant.
- F. 3. Spacing of joints shall be located about 4 feet from corners and intersections, and then at 25 feet on center thereafter.
- G. 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.

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1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- H. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed and corrections made.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - a. Do not supplement mechanical consolidation by hand, spading, rodding, or tamping unless approved by Architect.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Provide sufficient time for excess water to evaporate prior to placement of floor coverings.
- G. 1. Refer to floor covering product manufacturer submittals for requirements.

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- H. Cold-Weather Placement: Comply with ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- I. Hot-Weather Placement: Comply with ACI 305 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: 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: 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. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighen 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 exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-foot-long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/8 inch.

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- C. 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.
- D. Broom Finish: Apply a broom finish to exposed 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.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete 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. Misplaced or damaged anchor bolts will be subject to re-engineering fees.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306 for cold-weather protection and ACI 305 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

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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 penetrating liquid floor treatments as recommended by manufacturer.
 - b. 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 coverings 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.
 - b. Curing compound to be applied only in locations permitted or required.
 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
 - a. Curing and sealing compound to be applied only in locations permitted or required.

3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 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

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- 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. Exposed reinforcing steel shall be mechanically cleaned using sandblasting or waterblasting methods. Reinforcing steel shall be free from rust, grease, or other bond-inhibiting coating.
- F. Repairs of depths greater than 3 inches are not covered by this specification. Notify Architect if such conditions are discovered for further direction of repair methods and products.
- G. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- H. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 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.
- B. Inspections:

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1. Steel reinforcement placement.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight 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; 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, equilibrium 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.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 7. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 9. 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.
 10. 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, 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.
 11. 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.
 12. 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

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- may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 14. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 72 hours of finishing.

END OF SECTION 033000

ITEM 627.0004 25**MASONRY****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.
- 1.02 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0004 25**MASONRY****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

A. Section 042000 UNIT MASONRY

1.02 This item shall include, but not be limited to, the following:

A. Installation of new masonry units on the building's addition

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Concrete masonry units.
 2. Concrete building brick.
 3. Face brick.
 4. Mortar and grout.
 5. Steel reinforcing bars.
 6. Masonry joint reinforcement.
 7. Ties and anchors.
 8. Embedded flashing.
 9. Miscellaneous masonry accessories.
 10. Cavity-wall insulation.

1.2 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
- C. Qualification Data: For testing agency.
- D. Material Certificates: For each type and size of the following:
1. Masonry units.
 2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Grout mixes. Include description of type and proportions of ingredients.
 4. Reinforcing bars.
 5. Joint reinforcement.
 6. Anchors, ties, and metal accessories.
- E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
- F. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- G. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.4 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Installer Qualifications: The masonry installation contractor shall provide qualified installers. The International Masonry Institute (IMI) provides training and technical services to contractors will come to the job site to train masons in flashing fundamentals. Each employee shall receive this training prior to performing work on this project.
- E. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
 - 2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.

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3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide bullnose units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
1. Density Classification: Lightweight unless otherwise indicated.
 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 4. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.
- C. Concrete Building Brick: ASTM C 55.
1. Density Classification: Lightweight.

2.3 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

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2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face Brick: Facing brick complying with ASTM C 216.
1. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, 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.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
 - c. Solomon Colors, Inc.; SGS Mortar Colors.
- E. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- F. Aggregate for Grout: ASTM C 404.
- G. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951.
1. Interior Walls: Mill- galvanized, carbon steel.
 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 3. Wire Size for Side Rods: 0.148-inch diameter.
 4. Wire Size for Cross Rods: 0.148-inch diameter.
 5. Wire Size for Veneer Ties: 0.148-inch diameter.
 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 7. Provide in lengths of not less than 10 feet.

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- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
- D. Masonry Joint Reinforcement for Multiwythe Masonry:
 - 1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641, Class 1 coating.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
 - 3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, with ASTM A 153, Class B coating.
 - 4. Steel Plates, Shapes, and Bars: ASTM A 36.
- B. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 7.6 to 12.7 mm and an amplitude of 0.06 to 0.10 inch made from 0.030-inch-thick, steel sheet, galvanized after fabrication.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, stainless-steel wire.
 - 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch-diameter, stainless-steel wire.
- D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
- E. Partition Top anchors: 0.105-inch-thick metal plate with 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- F. Adjustable Masonry-Veneer Anchors:
 - 1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
 - 2. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
 - 3. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 213 or D/A 210 with D/A 700-708.

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- 2) Heckmann Building Products Inc.; 315-D with 316 or Pos-I-Tie.
- 3) Hohmann & Barnard, Inc.; DW-10, DW-10HS or DW-10-X.
- 4) Wire-Bond; 1004, Type III or RJ-711.
- b. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch-thick, steel sheet, galvanized after fabrication.
- c. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.187-inch-diameter, hot-dip galvanized steel wire.
4. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) ITW Buildex; Teks Maxiseal with Climaseal finish.
 - 2) Textron Inc., Textron Fastening Systems; Elco Dril-Flex with Stalgard finish.
5. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dayton Superior Corporation, Dur-O-Wal Division; Stainless Steel SX Fastener.
 - 2) ITW Buildex; Scots long life Teks.

2.7 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
- B. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of dimensions indicated.
- C. Postinstalled Anchors: Chemical anchors.
 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.8 EMBEDDED FLASHING MATERIALS

- A. Thru wall flashing system: A preassembled system that integrates a flashing membrane, drainage mat, weeps, and drip edge secured with a termination bar to the existing substrate.
 1. Manufacturer: Mortar Net
 2. Product: Total Flash System with the following options
 - a. Membrane: 5 oz Copper Laminate 18"
 - b. Termination Bar: 1-1/4 x 16 gauge thick
 - c. Drip Edge: 3 inch depth, 16 gauge thick with 3/8 inch hem.
 - d. Adhesive: As recommended by the manufacturer for the material specified
 - e. Preformed end dams and corner boots as required for a complete installation.

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- B. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07 Section "Sheet Metal Flashing and Trim."
- C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).
- D. Weep/Vent Products: Use the following unless otherwise indicated:
 - 1. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4 inches long.
 - 2. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
- E. Cavity Drainage Material: Pea gravel or free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Advanced Building Products Inc.; Mortar Break or Mortar Break II.
 - b. Archovations, Inc.; CavClear Masonry Mat.
 - c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
 - d. Mortar Net USA, Ltd.; Mortar Net.
 - 2. Provide one of the following configurations:
 - a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.
 - b. Strips, not less than 3/4 inch thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
 - c. Sheets or strips full depth of cavity and installed to full height of cavity.
 - d. Sheets or strips not less than 3/4 inch thick and installed to full height of cavity with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from clogging with mortar.
- F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
 - b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
 - d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.10 CAVITY-WALL INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, closed-cell product extruded with an integral skin.
- B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.11 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.12 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For reinforced masonry, use Type S.
 - 3. For mortar parge coats, use Type S.
 - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- C. Pigmented Mortar: 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. Mix to match Architect's sample.
 - 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Decorative CMUs.
 - b. Pre-faced CMUs.
 - c. Face brick.
 - d. Cast stone trim units.
- D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match existing mortar.
 - 2. Application: Use colored aggregate mortar for exposed mortar joints with the following units:
 - a. Pre-faced CMUs.

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- b. 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 Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the 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.
 - 1. 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. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:

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1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
- C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
 5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

- G. 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.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
 - 1. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
 - 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 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 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.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 ANCHORING 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. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
 - 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 o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.10 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 expansion joints in brick as follows:
 - 1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."
- C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND 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 vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
 3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
 4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 6. Install metal sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
 8. 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 head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - 1. Use specified weep/vent products or open head joints to form weep holes.
 - 2. Space weep holes 24 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, to maintain drainage.
 - 1. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- G. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products or open head joints to form vents.
 - 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.13 REINFORCED UNIT MASONRY INSTALLATION

- A. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- B. 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 ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches.

3.14 THRU WALL FLASHING INSPECTION PROCEDURE

- A. At all area of thru wall flashing installation the completed flashing assembly shall be tested for leaks by flood testing the assembly before the brick masonry is less than 2 feet above the bottom of the flashing material. Should the results indicate that the flashing is not watertight the brickwork shall be removed and flashing resealed until no leaks are present.
 - 1. Continue brick masonry construction only after the Construction Manager has verified that no leaks exist in the wall construction.

3.15 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. Level B special inspections are required for masonry in nonessential facilities designed by either analytical method and for essential facilities designed by empirical method; Level C for masonry in essential facilities (IBC Occupancy Category IV) designed by either analytical method.
- C. 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.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

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- 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.
- J. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.16 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.17 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. 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.
 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
 7. Clean stone trim to comply with stone supplier's written instructions.
 8. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.18 FIELD QUALITY CONTROL

- A. Notify Architect's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until Architect's Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.
- B. Inspecting: Owner will engage an inspector to perform inspections and prepare reports for thru wall flashing installation. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
- C. All thru wall flashing installed in this project shall be water tested to verify completed installations will perform as designed. These tests shall be witnessed and approved by the Architect.
 - 1. Testing will require that water be run into the brick cavity for a period of one hour to verify that no leaks exist. End dams are required at the end of all continuous through wall flashings so the water is directed to the weeps.

3.19 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 4 inches 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 Division 31 Section "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

ITEM 627.0005 25**METALS****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.
- 1.02 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0005 25**METALS****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

- A. Section 052100 STEEL JOIST FRAMING
- B. Section 053100 STEEL DECKING
- C. Section 055000 METAL FABRICATIONS

1.02 This item shall include, but not be limited to, the following:

- A. Detailing various components of metal fabrications, as well as steel joists and decking for the new roof of the building.

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. K-series steel joists.
 - 2. Joist accessories.

1.2 DEFINITIONS

- A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
- B. Design special joists to withstand design loads with live load deflections no greater than the following:
 - 1. Roof Joists: Vertical deflection of 1/240 of the span.
- C. Wind Uplift Loads:
 - 1. Eaves and Overhangs: 35 psf minimum.
 - 2. Roof Field: 20 psf minimum.

1.4 SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product indicated.
- B. Shop Drawings: Show layout, designation, number, type, location, and spacing of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.
 - 1. Indicate locations and details of bearing plates to be embedded in other construction.
 - 2. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.
- C. Welding certificates.
- D. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.
- E. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.
- F. Qualification Data: For manufacturer and professional engineer.
- G. Field quality-control test and inspection reports.
- H. Research/Evaluation Reports: For joists.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

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- C. Welding: Qualify field-welding procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.6 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.

1.7 SEQUENCING

- A. Deliver steel bearing plates to be built into cast-in-place concrete and 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.
 - 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.

2.2 MATERIALS

- A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.
- B. Steel Bearing Plates: ASTM A 36.
- C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
 - 1. Finish: Plain, uncoated.

2.3 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type: K-series steel joists].
- B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- C. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- D. Do not camber joists.
- E. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.
- F. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
- G. Primer: Provide shop primer that complies with Division 09 Sections "Exterior Painting", "Interior Painting", and "High-Performance Coatings".

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 steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint.
- C. Supply 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.
- D. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.
- E. 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.
- F. Welding Electrodes: Comply with AWS standards.

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 1 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.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.
- C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - 1. Weld and bolt joists with end movement connections as indicated.

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- D. Bolt joists to supporting steel framework using carbon-steel bolts, 2-3/4-inch minimum.
- E. 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.
- F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.
- B. Field welds will be visually inspected according to AWS D1.1.
- C. Bolted connections will be visually inspected.
- 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. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- F. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

- A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
 - 1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- B. 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 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Roof deck.

1.2 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: For each type of steel deck, signed by product manufacturer.
- D. Welding certificates.
- E. Field quality-control test and inspection reports.
- F. 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.
- G. Evaluation Reports: For steel deck, from ICC-ES.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.
- B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- C. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

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: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Indicate by design designations of applicable testing and inspecting agency.

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2. Indicate design designations from UL's "fire Resistance Directory" or from the listings of another qualified testing agency

2.2 MANUFACTURERS

- A. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Steel Deck:
 - a. Epic Metals Corporation.
 - b. Nucor Corp.; Vulcraft Division.
 - c. Roof Deck, Inc.
 - d. United Steel Deck, Inc.
 - e. Verco Manufacturing Co.

2.3 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 1. Galvanized Steel Sheet: ASTM A 653, Structural Steel, Grade 33, G60 zinc coating.
 2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Structural Steel, Grade 33, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: White.
 3. Deck Profile: Type WR, wide rib.
 4. Profile Depth: 1-1/2 inches, unless otherwise indicated.
 5. Design Uncoated-Steel Thickness: 0.0358 inch.
 6. Span Condition: As indicated.
 7. Side Laps: Overlapped.

2.4 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. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. 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.
- F. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- G. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

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- H. 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.
- I. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.
- K. 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 flat and square and fasten to supporting frame without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- H. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches apart in the field of roof and 6 inches apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.
 - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Fasten with a minimum of 1-1/2-inch- long welds.

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- 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.
- 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 12 inches apart with at least one fastener at each corner.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- 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.
- G. Sound-Absorbing Insulation: Installation into topside ribs of deck as specified in in Division 07 Section "Roofing".

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. 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 Sections "Exterior Painting" and "Interior Painting."
- 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 3100

SECTION 055000 - METAL FABRICATIONS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 2. Shelf angles.
 - 3. Loose bearing and leveling plates for applications where they are not specified in other Sections.
- B. Products furnished, but not installed, under this Section:
 - 1. Loose steel lintels. Loose steel headers
 - 2. Anchor bolts, steel pipe sleeves.

1.2 SUBMITTALS

- A. Product Data: For the following:
 - 1. Paint products.
 - 2. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.3 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1 "Structural Welding Code - Steel."

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.5 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. 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.

PART 2 - PRODUCTS**2.1 METALS, GENERAL**

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36.
- C. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- D. Steel Pipe: ASTM A 53, standard weight (Schedule 40) unless otherwise indicated.
- E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches unless otherwise indicated.
 - 2. Material: Cold-rolled steel, ASTM A 1008, structural steel, Grade 33; 0.0528-inch minimum thickness; unfinished.
- F. Cast Iron: Either gray iron, ASTM A 48, or malleable iron, ASTM A 47, unless otherwise indicated.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 2.
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- F. Post-Installed Anchors: Chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- G. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

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- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. 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.
- E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- G. 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 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.

2.7 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.

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- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.8 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION**3.1 INSTALLATION, GENERAL**

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.

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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.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 1. Use nonshrink, nonmetallic grout in all locations unless otherwise indicated.
 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

ITEM 627.0006 25**WOOD, PLASTICS AND COMPOSITES****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.
- 1.02 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0006 25**WOOD, PLASTICS AND COMPOSITES****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

- A. Section 061053 MISCELLANEOUS ROUGH CARPENTRY
- B. Section 062023 INTERIOR ARCHITECTURAL WOODWORK

1.02 This item shall include, but not be limited to, the following:

- A. Placement of various interior components for the new break room in the building's addition
- B. Miscellaneous interior architectural components

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Framing with dimension lumber.
 2. Wood blocking, cants, and nailers.
 3. Plywood backing panels.

1.2 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NHLA: National Hardwood Lumber Association.
 3. NLGA: National Lumber Grades Authority.
 4. SPIB: The Southern Pine Inspection Bureau.
 5. WCLIB: West Coast Lumber Inspection Bureau.
 6. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
1. Preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Power-driven fasteners.
 4. Powder-actuated fasteners.
 5. Expansion anchors.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS**2.1 WOOD PRODUCTS, GENERAL**

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 2. 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. Kiln-dry lumber after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

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- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Concealed blocking.
 - 2. Plywood backing panels.

2.4 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 stainless steel.
- B. Screws for Fastening to Metal Framing: ASTM C 1002 or ASTM C 954 as required for application, length as recommended by screw manufacturer for material being fastened.
- C. Lag Bolts: ASME B18.2.1.
- D. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- E. 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.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.6 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION**3.1 INSTALLATION, GENERAL**

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- E. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- F. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

END OF SECTION 0610

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY**A. Section Includes:**

1. Interior standing and running trim.
2. Wood furring, blocking, shims, and hanging strips for installing interior architectural woodwork items that are not concealed within other construction.

1.2 PREINSTALLATION MEETINGS**A. Preinstallation Conference:** Conduct conference at Project site.**1.3 ACTION SUBMITTALS****A. Product Data:** For the following:

1. Anchors.
2. Adhesives.
3. Shop finishing materials.

B. Shop Drawings:

1. Include the following:
 - a. Dimensioned plans, elevations, and sections.
 - b. Attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.

C. Samples: For each exposed product and for each shop-applied color and finish specified.**1.4 INFORMATIONAL SUBMITTALS****A. Qualification Data:** For architectural woodwork manufacturer.**B. Product Certificates:** For the following:

1. Adhesives.

1.5 CLOSEOUT SUBMITTALS**A. Quality Standard Compliance Certificates:** AWI Quality Certification Program certificates.**1.6 QUALITY ASSURANCE****A. Manufacturer's Certification:** Licensed participant in AWI's Quality Certification Program.**B. Mockups:** Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups of typical interior architectural woodwork as shown on Drawings.

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2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

PART 2 - PRODUCTS**2.1 ARCHITECTURAL WOODWORK, GENERAL**

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Architectural Woodwork Standards Grade: Premium.
- B. Hardwood Lumber:
 1. Species: Select Red Oak.
 2. Cut: Plain sliced/plain sawn.
 3. Wood Moisture Content: 8 to 13 percent.
 4. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished. For base wider than available lumber, glue for width. Do not use veneered construction.

2.3 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
 1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
 2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.4 FABRICATION

- A. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.

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1. Ease edges to radius indicated for the following:
 - a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
 - b. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.
 1. Disassemble components only as necessary for shipment and installation.
 2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
 3. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
 - a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
 - b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

2.5 SHOP PRIMING

- A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
- B. Interior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer.
 1. Backpriming: Apply one coat of primer, compatible with finish coats, to concealed surfaces of woodwork.
- C. Interior Architectural Woodwork for Transparent Finish: Shop-seal concealed surfaces with required pretreatments and first coat of finish.
 1. Backpriming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of woodwork.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.
- B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

- A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.
- B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.
- C. Install interior architectural woodwork level, plumb, true in line, and without distortion.

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1. Shim as required with concealed shims.
 2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
1. Use **finishing screws** for exposed fastening, countersunk and filled flush with interior architectural woodwork.
 2. For shop-finished items, use filler matching finish of items being installed.
- F. Standing and Running Trim:
1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
 2. Do not use pieces less than 36 inches long, except where shorter single-length pieces are necessary.
 3. Scarf running joints and stagger in adjacent and related members.
 4. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
 5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

END OF SECTION 064023

ITEM 627.0007 25**THERMAL AND MOISTURE PROTECTION****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.
- 1.02 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0007 25**THERMAL AND MOISTURE PROTECTION****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

- A. Section 070150.19 PREPARATION FOR REROOFING
- B. Section 072100 THERMAL INSULATION
- C. Section 074213 METAL WALL PANELS
- D. Section 075323 EPDM ROOFING
- E. Section 076200 SHEET METAL FLASHING AND TRIM
- F. Section 077100 ROOF SPECIALTIES
- G. Section 079200 JOINT SEALANTS

1.02 This item shall include, but not be limited to, the following:

- A. Roofing components needed for the replacement of the existing roof and the construction of the new roof over the building's addition.
- B. Exterior siding for the building's addition such as metal wall panels.

SECTION 070150.19 - PREPARATION FOR REROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Full tear-off of roof system at areas indicated on Drawings.
 - 2. Removal of flashings and counterflashings.
 - 3. Temporary roofing.
- B. Related Requirements:
 - 1. Division 23 Sections for HVAC equipment removal and reinstallation.
 - 2. Division 26 Sections for electrical equipment disconnection and reconnection.

1.2 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. Full Roof Tear-off: Removal of existing roofing system down to existing concrete deck.
- C. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and reinstalled.
- D. Existing to Remain: Existing items of construction that are not indicated to be removed.

1.3 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting removal Work, conduct conference at Project site.
 - 1. Meet with Owner's Representative, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing tear-off, including, but not limited to, the following:
 - a. Reroofing preparation, including roofing system manufacturer's written instructions.
 - b. Temporary protection requirements for existing roofing system components that are to remain.
 - c. Existing roof drains and roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.
 - d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
 - e. Existing roof deck conditions requiring Owner's Representative and Architect notification.
 - f. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
 - g. Structural loading limitations of roof deck during reroofing.
 - h. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
 - i. HVAC shutdown and sealing of air intakes.

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- j. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
- k. Asbestos removal and discovery of asbestos-containing materials.
- l. Governing regulations and requirements for insurance and certificates if applicable.
- m. Existing conditions that may require Architect notification before proceeding.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Temporary Roofing Submittal: Product data and description of temporary roofing system.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
 - 1. Include certificate that Installer is approved by warrantor of existing roofing system.
 - 2. Include certificate that Installer is licensed to perform asbestos abatement.
- B. Photographs or Videotape: Show existing conditions of existing roof construction after roofing is removed adjoining construction and site improvements, including condition of blocking and other elements to remain, that can affect reroofing.
 - 1. Submit before new Work begins.

1.6 FIELD CONDITIONS

- A. Existing Roofing System: EPDM roof over (older) layers of: foam insulation, tar paper, and screed.
- B. Owner will occupy portions of building immediately below reroofing area.
 - 1. Conduct reroofing so Owner's operations are not disrupted.
 - 2. Provide Owner with not less than 72 hours' written notice of activities that may affect Owner's operations.
 - 3. Coordinate work activities daily with Owner so Owner has adequate advance notice to place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.
- C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- E. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
 - 1. Construction Drawings for existing roofing system are provided for Contractor's convenience and information, but they are not a warranty of existing conditions. They are intended to supplement rather than serve in lieu of Contractor's own investigations. Contractor is responsible for conclusions derived from existing documents.
- F. Limit construction loads on existing roof areas to remain, and existing roof areas scheduled to be reroofed to loads defined in Building Codes of NYS for uniformly distributed loads.

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- G. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
 - 1. Remove only as much roofing in one day as can be made watertight in the same day.
- H. Hazardous Materials: A report on the presence of hazardous materials is included in this Project Manual. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except according to procedures specified elsewhere in the Contract Documents.
 - 3. Coordinate reroofing preparation with hazardous material remediation to prevent water from entering existing roofing system or building.

PART 2 - PRODUCTS

2.1 TEMPORARY PROTECTION MATERIALS

- A. Plywood: DOC PS 1, Grade CD, Exposure 1.
- B. OSB: DOC PS 2, Exposure 1.

2.2 TEMPORARY ROOFING MATERIALS

- A. Design and selection of materials for temporary roofing are Contractor's responsibilities. Examples of temporary roofing materials are listed below.
- B. Base Sheet: ASTM D4601/D4601M, Type II, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet.
- C. Glass-Fiber Felts: ASTM D2178/D2178M, Type IV, asphalt-impregnated, glass-fiber felt.
- D. Asphalt Primer: ASTM D41/D41M.
- E. Roofing Asphalt: ASTM D312/D312M, Type III or IV.
- F. Base Sheet Fasteners: Capped head, factory-coated steel fasteners, listed in FM Approvals' RoofNav.

2.3 REPLACEMENT MATERIALS

- A. Wood blocking, curbs, and nailers are specified in Section 061053 Miscellaneous Rough Carpentry."
- B. Fasteners: Factory-coated steel fasteners with metal or plastic plates listed in FM Approvals' RoofNav, and acceptable to new roofing system manufacturer.

2.4 AUXILIARY REROOFING MATERIALS

- A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new roofing system.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
- B. Seal or isolate windows that may be exposed to airborne substances created in removal of existing materials.
- C. Shut off rooftop utilities and service piping before beginning the Work.
- D. Test existing roof drains to verify that they are not blocked or restricted.
 - 1. Immediately notify Owner's Representative of any blockages or restrictions.
- E. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- F. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday.
 - 1. Prevent debris from entering or blocking roof drains and conductors.
 - a. Use roof-drain plugs specifically designed for this purpose.
 - b. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
 - 2. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding.

3.2 ROOF TEAR-OFF

- A. Notify Owner's Representative each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.
- B. Lower removed roofing materials to ground and onto lower roof levels, using dust-tight chutes or other acceptable means of removing materials from roof areas.
- C. Remove Owner's accessories from roofing.
 - 1. Disconnect and salvage existing antenna(s), coordinate temporary storage of salvaged items with Owner's representative.
 - 2. Disconnect and salvage existing condensing unit, coordinate temporary storage with Owner's Representative.
- D. Full Roof Tear-off: Where indicated on Drawings, remove existing roofing and other roofing system components down to the existing concrete deck.
 - 1. Refer to Abatement drawings for abatement scope of work.
 - 2. For roof components not requiring abatement provide the following:
 - a. Remove all layers of existing roofing.
 - b. Remove base flashings and counter flashings.
 - c. Remove perimeter edge flashing
 - d. Remove flashings at pipes, curbs, mechanical equipment, and other penetrations.

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- e. Remove roof drains components indicated on Drawings to be removed.
- f. Remove wood blocking, curbs, and nailers, unless noted otherwise.
- g. Inspect wood blocking, curbs, and nailers for deterioration and damage. If wood blocking, curbs, or nailers have deteriorated, immediately notify Architect through the Owner's Representative.
- g. Remove unadhered bitumen, unadhered felts, and wet felts.

3.3 DECK PREPARATION

- A. Inspect deck after tear-off of roofing system.
- B. Refer to Section 030130 Concrete Deck Repairs.

3.4 TEMPORARY ROOFING

- A. Install approved temporary roofing over area to be reroofed as required by the project schedule.

3.5 DISPOSAL

- A. Collect demolished materials and place in containers.
 - 1. Promptly dispose of demolished materials.
 - 2. Do not allow demolished materials to accumulate on-site.
 - 3. Storage or sale of demolished items or materials on-site is not permitted.
- B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 070150.19

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Glass-fiber blanket.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

1.5 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Owens Corning.
 - 1) Product: Sound Attenuation Batt Insulation (SAB)
 - b. Thicknesses
 - 1) 3-1/2"
 - 2) 5-1/2"

1.6 MINERAL-WOOL INSULATION

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 70 percent.

PART 2 - EXECUTION

2.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

2.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

2.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

2.4 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 074213 – METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes complete system of concealed-fastener, lap-seam metal panels in the following applications:
1. Metal wall panels.

1.2 REFERENCES

- A. Reference Standards:
1. ASCE 7: Minimum Design Loads for Buildings and Other Structures.
 2. ASTM A653: Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.
 3. ASTM A792: Steel Sheet, 55 % Aluminum Zinc Alloy Coated by the Hot Dip Process.
 4. ASTM C1371: Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
 5. ASTM C1549: Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
 6. ASTM D523: Specular Gloss.
 7. ASTM E283: Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 8. ASTM E331: Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
 9. ASTM E1592: Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
 10. ASTM E1918: Measuring Solar Reflectance of Horizontal and Low Sloped Surfaces in the Field.
 11. ASTM E1980: Calculating Solar Reflectance Index of Horizontal and Low Sloped Opaque Surfaces.
 12. CRRC-1 Method #1: Measuring Solar Reflectance of a Flat, Opaque, and Heterogeneous Surface Using a Portable Solar Reflectometer.
 13. SMACNA Architectural Sheet Metal Manual.

1.3 SUBMITTALS

- A. Product Data.
- B. Shop Drawings:
1. Indicate thickness and dimensions of parts, fastenings and anchoring methods, details and locations of joints, transitions and other provisions necessary for thermal expansion and contraction.
 2. Indicate locations of field- and factory-applied sealant.
- C. Samples:
1. Submit two samples, 12 inches long by full panel width, showing proposed metal thickness and seam profile.
 2. Submit standard color samples of metal for Architect's selection.

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- D. Manufacturer Qualifications.
- E. Installer Qualifications: Submit list of completed projects, with names and contact information for architects and contractors.
- F. Test Reports: Indicating compliance of products with project requirements.
- G. Warranty Documentation.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Ten years' experience, minimum, in factory fabrication of metal panels.
 - 2. Manufacturer shall carry \$2,000,000 liability insurance, minimum, for metal panel system.
- B. Installer Qualifications:
 - 1. Three years' experience, minimum, in application of metal roof or wall panels.
 - 2. Five satisfactory projects with metal panel work of similar scope and complexity to Work of this Project.
- C. Product Testing Agency Qualifications: Agency compliant with ISO/IEC Standard 17025, or an accredited independent agency recognized by the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement or ANSI.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements:
 - 1. Keep panels and accessory items dry.
 - 2. Protect against damage and discoloration.
 - 3. Handle panels with non-marring slings.
 - 4. Support panels to prevent permanent deformation.
 - 5. Store panels above ground, with one end elevated for drainage.
 - 6. Protect panels against standing water and condensation between adjacent surfaces.
 - 7. If panels become wet, immediately separate sheets, wipe dry with clean cloth, and keep sheets separate for air-drying.
 - 8. Painted panels shall be shipped with protective plastic sheeting or a strippable film coating between panels. Remove strippable film coating prior to installation. Do not allow strippable film coating to remain on panels in extreme heat, cold, or direct sunlight or other UV source.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard 25-year performance warranty, stating the following:
 - 1. Architectural fluorocarbon finish:
 - a. Will be free of fading or color change in excess of 5 Hunter delta-E units as determined by ASTM D2244-02.
 - b. Will not chalk in excess of numerical rating of 8 when measured in accordance with standard procedures specified in ASTM D4214-98 method D659.
 - c. Will not peel, crack, chip, or delaminate.
 - 2. Metal substrate will not rupture, fail structurally, or perforate.
- B. Installer's Warranty: Warrant panels, flashings, sealants, fasteners and accessories against defective materials and/or workmanship, covering repairs required to maintain wall panels

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watertight and weatherproof with normal usage for two years following Project Substantial Completion date.

1. Furnish written warranty, signed by installer.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Products: Provide the following:

1. AEP Span, a Division of ASC Profiles, LLC.; Flex Series.

B. Performance Criteria

1. Wind Uplift: As required by ASCE 7
2. Panel system shall be ASTM E1592 tested under the supervision of an ANSI or ISO/IEC accredited laboratory and the laboratory shall issue the test report. Test data based on ASTM E330 is not acceptable.
3. Deflection Limits: Withstand wind loads with deflections no greater than 1/180 of the span.
4. Air Infiltration: 0.01 cfm/lf, maximum at a static difference of 6.24 psf when tested with sidelap sealant per ASTM E283.
5. Water Penetration Under Static Pressure: No leakage at 20 psf when tested with sidelap sealant per ASTM E331.
6. Thermal Movements: Accommodate thermal movement without buckling, joint opening, failure of connections, or other detrimental effects, through the following temperature changes:
 - a. 120 degrees F, ambient.
 - b. 180 degrees F, surface.

2.2 PANELS

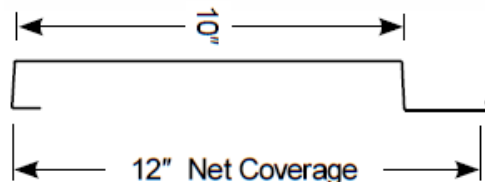
A. Panel: AEP Span, a Division of ASC Profiles, LLC; Flex Series

B. Material: Steel conforming to ASTM A792.

1. 22 Gauge: Yield strength 50,000 psi; with aluminum-zinc alloy coating conforming to ASTM A792, Class AZ50.

C. Profile and Pattern:

1. 10" rib with 2" reveal, 1.2FX20-12 (1 ¼" rib height)



2. Panel to substrate attachment: Clip Attached

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- D. Finishes:
1. Exterior Panel Finish: Provide primer and finish coat on exposed faces; provide primer on concealed faces of panels.
 - a. DuraTech® 5000: Polyvinylidene Fluoride, full 70 percent Kynar 500/Hylar 5000, consisting of a baked-on 0.15-0.20 mil corrosion resistant primer and a baked-on 0.70-0.80 mil finish coat with a specular gloss of 8 to 15 when tested in accordance with ASTM D523 at 60 degrees.
 - b. Exterior Panel Color: Sage Green.
 2. Interior Panel Finish: Corrosion-resistant primer; primer coat dry film thickness: 0.15 mils; polyester paint; dry film thickness of 0.35 mils, off-white to light gray in color.
- E. Sustainability Characteristics:
1. Recycled Content: 27 percent post-consumer recycled content.
 2. Solar Performance:
 - a. Solar reflective index (SRI): Not less than 29 per ASTM E1980.
- F. Manufacturing Characteristics: Provide panels complying with provisions of Buy American Act 41 U.S. C 10a - 10d.

2.3 ACCESSORIES

- A. Clip: Panel clip with pre-drilled holes attachment holes at one end and panel hook at other end, sized to fit panels.
1. Product: AEP Span; Flex Series Flush Mount Clip.
 - a. Material: 18 gauge (.0438 Min.), 40ksi yield min., G90 galvanized, material in conformance with ASTM A-653 Class G90.
 - b. Panel clips to be of proper design to resist uplift forces and reduce permanent deflection of panel assembly under design loads. Panel system manufacturer to provide proof that this has been addressed through use of clip strengthening ribs, short clip reach, or similar.
- B. Trims and Flashings: Material, metal thickness, and finish to match panels. Profiles indicated in Drawings.
- C. Panel Penetration Flashings: As recommended by panel manufacturer.
- D. Fasteners: Per manufacturer recommendation.
- E. Profile Closures: Polyethylene foam, die-cut or formed to panel configuration.
- F. Sealant for Field Application: See Section 07 92 00 "Joint Sealants".

2.4 FABRICATION

- A. Fabrication, General:
1. Unless otherwise shown on Drawings or specified herein, fabricate panels in continuous lengths and fabricate flashings and accessories in longest practical lengths.
 2. Panels shall be factory correctively-leveled.
- B. Fabrication Tolerances:
1. Flat metal surfaces will display waviness commonly referred to as "oil canning". This is caused by steel mill tolerances and is a characteristic, not a defect, of panels manufactured from light gauge metal. Panels are factory correctively-leveled to minimize the occurrence of "oil canning". As such, "oil canning" will not be accepted as cause for rejection.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: With Installer present.
 - 1. Examine conditions and substrates on which metal panels are to be installed. Structural support or substrate shall be flat and plumb to avoid panel stresses and distortion.
 - 2. Prior to starting work, correct defects.
- B. Field Measurements:
 - 1. Coordinate field measurements and fabrication schedule with construction progress.
 - 2. Field measure prior to fabrication. Show recorded dimensions on shop drawings, including locations of shop-fabricated openings.
 - 3. If field measurements differ from drawing dimensions, notify Architect prior to fabrication.
- C. Framing and Substrate Tolerances: Deviations from flat plane shall not exceed the following.
 - 1. 1/4 inch in 20 feet vertically or horizontally.
 - 2. 1/8 inch in 5 feet.

3.2 PREPARATION

- A. Protection:
 - 1. Treat contacting surfaces of dissimilar materials to prevent electrolytic corrosion.
 - 2. Where panels or trim may come in contact with dissimilar materials or treated lumber, fabricate transitions to facilitate drainage and minimize possibility of galvanic corrosion.
 - 3. At points of contact with dissimilar metal or treated lumber, coat panel or trim with protective paint or separate materials with a weatherproof underlayment.
 - 4. Direct contact or run-off from CCA, ACQ, AC, or other treated lumber (outdoor wood) or fire retardant impregnated or treated wood shakes or siding can cause panels and trim to fail prematurely. Avoid contact with these materials.

3.3 INSTALLATION

- A. Secondary Framing: Install according to approved shop drawings and metal panel manufacturer's recommendations.
- B. Panels and Flashing:
 - 1. Install according to approved shop drawings.
 - 2. Comply with methods and recommendations of SMACNA Architectural Sheet Metal Manual for flashing configurations required.
 - 3. Overlap flashing at least 6 inches.
 - 4. Discrepancies between job site conditions and shop drawings shall be brought to the attention of the Architect for resolution.
 - 5. Cutting and Fitting:
 - a. Cut panels neat, square, and true with shearing action cutters. Torch or power saw cutting is prohibited.
 - b. Openings 6 inches and larger: Shop fabricate and reinforce to maintain original load capacity.
 - c. Openings less than 6 inches: Field cutting is acceptable.
- C. Accessories: Install trims, panel closures, flashings according to Drawings and manufacturer's recommended details.

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- D. Sealant Installation: Apply according to approved shop drawings and SMACNA Architectural Sheet Metal Manual recommendations.
- E. Installation Tolerances: Match dimensional tolerances of framing or substrate.

3.4 CLEANING

- A. Repairs:
 - 1. Touch up paint is not required for panels with scratches that do not expose metal.
 - 2. Panels or flashings with finish damage exposing metal or with substrate damage shall be replaced.
- B. Cleaning and Waste Management: At completion of each day's work and at work completion, sweep panels, flashings, and gutters clean. Do not allow fasteners, cuttings, filings, or scraps to accumulate.

END OF SECTION

SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Project is located in Weedsport, N.Y.
- B. The project consists of installing Fully Adhered EPDM Roofing System with a 20 Year Total Systems Warranty as outlined below.
- C. Basis-of-Design System: Carlisle.
- D. **Metal Deck Areas:** Mechanically fasten 1/2" Carlisle Securock to meet the required uplift ratings but no less than 1 every 2 sq. ft. in the field and perimeter and 1 every 1 sq. ft. in the corners. Prime the substrate board with NYS VOC OTC compliant primer, Carlisle Cav-Grip. Install Carlisle VapAir Seal 725 TR vapor retarder. Adhesively attach Carlisle Polyisocyanurate insulation and Carlisle water resistant 3/8" Securock gypsum overlayment board with Carlisle Fast adhesive 4" on center in the field, perimeter & corners. Insulation must meet minimum R-30 to meet code. Fully adhere Carlisle .060 non-reinforced EPDM in accordance with current specifications and details.
- E. **Concrete Deck:** Completely remove existing roofing and flashing materials down to the existing structural deck. Prime the deck with NYS VOC OTC compliant primers, Carlisle CavGrip. Install Carlisle 725TR vapor retarder. Adhesively attach Carlisle Polyisocyanurate insulation and 3/8" Securock water resistant gypsum overlayment board with Carlisle Flexible Fast adhesive 4" on center in the field, perimeter and corners. Insulation must meet minimum R-30 to meet code. Fully adhere Carlisle .060 non-reinforced EPDM in accordance with current specifications and details.
- F. Provide owner with a 20 year, 72 MPH total system edge-to-edge warranty.

1.2 EXTENT OF WORK

- A. Provide all labor, material, tools, equipment, and supervision necessary to complete the installation of a .060 inch thick non-reinforced EPDM membrane Fully Adhered Roofing System including flashings and insulation as specified herein and as indicated on the drawings in accordance with the manufacturer's most current specifications and details.
- B. The roofing contractor shall be fully knowledgeable of all requirements of the contract documents and shall make themselves aware of all job site conditions that will affect their work.
- C. The roofing contractor shall confirm all given information and advise the building owner, prior to bid, of any conflicts that will affect their cost proposal.
- D. Any contractor who intends to submit a bid using a roofing system other than the approved manufacturer must submit for pre-qualification in writing ten (10) days prior to the bid date. Any contractor who fails to submit all information as requested will be subject to rejection. Bids stating "as per plans and specs" will be unacceptable.

1.3 SUBMITTALS

- A. Prior to starting work, the roofing contractor must submit the following:
 - 1. Shop drawings showing layout, details of construction and identification of materials.
 - 2. Sample of the manufacturer's Membrane System Warranty.
 - 3. Submit a letter of certification from the manufacturer which certifies the roofing contractor is authorized to install the manufacturer's roofing system and lists foremen who have received training from the manufacturer along with the dates training was received.

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4. Certification of the manufacturer's warranty reserve.

B. Upon completion of the installed work, submit copies of the manufacturer's final inspection to the specifier prior to the issuance of the manufacturer's warranty.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, unopened containers or wrappings with the manufacturer's name, brand name and installation instructions intact and legible. Deliver in sufficient quantity to permit work to continue without interruption.

B. Comply with the manufacturer's written instructions for proper material storage.

1. Store materials, except membrane, between 60°F and 80°F in dry areas protected from water and direct sunlight. If exposed to lower temperature, restore to 60°F minimum temperature before using.
2. Store materials containing solvents in dry, well-ventilated spaces with proper fire and safety precautions. Keep lids on tight. Use before expiration of their shelf life.

C. Insulation must be on pallets, off the ground and tightly covered with waterproof materials.

D. Any materials which are found to be damaged shall be removed and replaced at the applicator's expense.

1.5 WORK SEQUENCE

A. Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Care should be exercised to provide protection for the interior of the building and to ensure water does not flow beneath any completed sections of the membrane system.

B. Do not disrupt activities in occupied spaces.

1.6 USE OF THE PREMISES

A. Before beginning work, the roofing contractor must secure approval from the building owner's representative for the following:

1. Areas permitted for personnel parking.
2. Access to the site.
3. Areas permitted for storage of materials and debris.
4. Areas permitted for the location of cranes, hoists and chutes for loading and unloading materials to and from the roof.
5. Interior stairs or elevators may not be used for removing debris or delivering materials, except as authorized by the building superintendent.

1.7 EXISTING CONDITIONS

If discrepancies are discovered between the existing conditions and those noted on the drawings, immediately notify the owner's representative by phone and solicit the manufacturer's approval prior to commencing with the work.

1.8 TEMPORARY FACILITIES AND CONTROLS

A. Temporary Utilities:

1. Water, power for construction purposes and lighting are not available at the site and will not be made available to the roofing contractor.

B. Temporary Sanitary Facilities

1. Sanitary facilities will not be available at the job site. The roofing contractor shall be responsible for the provision and maintenance of portable toilets or their equal.

C. Building Site

1. The roofing contractor shall use reasonable care and responsibility to protect the building and site against damages. The contractor shall be responsible for the correction of any damage incurred as a result of the performance of the contract.
2. The roofing contractor shall remove all debris from the job site in a timely and legally acceptable manner.

D. Security

1. Obey the owner's requirements for personnel identification, inspection and other security measures.

1.9 JOB SITE PROTECTION

- A. The roofing contractor shall adequately protect building, paved areas, service drives, lawn, shrubs, trees, etc. from damage while performing the required work. Provide canvas, boards and sheet metal (properly secured) as necessary for protection and remove protection material at completion.
- B. Do not overload any portion of the building, either by use of or placement of equipment, storage of debris, or storage of materials.
- C. Protect against fire and flame spread. Maintain proper and adequate fire extinguishers.
- D. Take precautions to prevent drains from clogging during the roofing application. Remove debris at the completion of each day's work and clean drains, if required.
- E. Store moisture susceptible materials above ground and protect with waterproof coverings.

1.10 SAFETY

- A. The roofing contractor shall be responsible for all means and methods as they relate to safety and shall comply with all applicable local, state and federal requirements that are safety related. **Safety shall be the responsibility of the roofing contractor.** All related personnel shall be instructed daily to be mindful of the full time requirement to maintain a safe environment for the facility's occupants including staff, visitors, customers and the occurrence of the general public on or near the site.

1.11 WORKMANSHIP

- A. Applicators installing the new roof, flashing and related work shall be factory trained and approved by the membrane manufacturer.
- B. All work shall be of highest quality and in strict accordance with the manufacturer's published specifications and to the building owner's satisfaction.
- C. There shall be a supervisor on the job site at all times while work is in progress.

1.12 QUALITY ASSURANCE

- A. The EPDM membrane roofing system must achieve a UL Class A rating and be installed to Factory Mutual standards.
- B. The specified roofing assembly must have been successfully tested by a qualified testing agency (ANSI/FM 44747) to resist the design uplift pressures calculated according to state adopted agency:
 1. American Society of Civil Engineers (ASCE 7)
 2. International Building Code (IBC)
 3. Minimum accepted assembly uplift rating is 90-lbs/sqft
- C. The manufacturer must have a minimum of 20 (twenty) years experience in the manufacturing of vulcanized thermal set sheeting and must be the primary manufacturer of the EPDM membrane, membrane adhesives and membrane accessories. Secondary "marketers" of roofing systems will not be

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acceptable. The manufacturer must have warranty reserve fund. Evidence of this requirement shall be submitted in accordance with section 1.03.

- D. The roofing system must be installed by an applicator authorized and trained by the manufacturer in compliance with shop drawings as approved by the manufacturer. The roofing applicator shall be thoroughly experienced and upon request be able to provide evidence of having at least 10 (ten) years successful experience installing single-ply EPDM roofing systems and having installed at least 10 (ten) roofing applications of similar or equal scope. Roofing contractors must have a working office and warehouse location within 200 miles of project location to ensure prompt service of any potential issues or emergencies. Unless otherwise noted in this specification, the roofing contractor must strictly comply with the manufacturer's current specifications and details.
- E. Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified. Provide at least one thoroughly trained and experienced superintendent on the job at all times roofing work is in progress.

Provide weekly inspections and provide written documentation to architect by a full time non-sales technical representative of membrane manufacturer or by a Registered Roof Observer.

- F. There shall be no deviations made from this specification or the approved shop drawings without the prior written approval of the specifier. Any deviation from the manufacturer's installation procedures must be supported by a written certification on the manufacturer's letterhead and presented for the specifier's consideration.
- G. Upon completion of the installation, the applicator shall arrange for an inspection to be made by a non-sales technical representative of the membrane manufacturer in order to determine whether or not corrective work will be required before the warranty will be issued. Notify the building owner seventy-two (72) hours prior to the manufacturer's final inspection.

1.13 JOB CONDITIONS, CAUTIONS AND WARNINGS

- A. Material Safety Data Sheets (MSDS) must be on location at all times during the transportation, storage and application of materials.
- B. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.
- C. When loading materials onto the roof, the Carlisle Authorized Roofing Applicator must comply with the requirements of the building owner to prevent overloading and possible disturbance to the building structure.
- D. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.
- E. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.
- F. Provide protection, such as 3/4-inch thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.
- G. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.
- H. New roofing shall be complete and weathertight at the end of the workday.
- I. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

1.14 WARRANTY

- A. Provide manufacturer's 20 year Edge-to-Edge Total System Warranty covering both labor and material with no dollar limitation. The maximum wind speed coverage shall be peak gusts of 72 mph measured at 10 meters above ground level. Certification is required with submittals indicating the manufacturer has reviewed and agreed to such wind coverage. All products including substrate boards, vapor retarders, insulation, fasteners, fastening plates and edgings must be manufactured and/or supplied by the roofing system manufacturer and covered by the warranty.
- B. Pro-rated Warranties shall not be accepted.
- C. Evidence of the manufacturer's warranty reserve shall be included as part of the project submittals for the specifier's approval.

PART 2 - PRODUCTS**2.1 GENERAL**

- A. Roofing system is based upon the products of Carlisle SynTec Incorporated. Acceptable manufacturers are listed below:
 - 1. Carlisle Syntec (basis of design)
 - 2. Approved equal
- B. All products including substrate boards, vapor retarders, insulation, fasteners, fastening plates and edgings must be manufactured and/or supplied by the roofing system manufacturer and covered by the warranty.

2.2 MEMBRANE

- A. Furnish Carlisle .060 inch thick non-reinforced EPDM. The membrane shall conform to the minimum physical properties of ASTM D4637, or equal. When a 10-foot wide membrane is to be used, the membrane shall be manufactured in a single panel with no factory splices to reduce splice intersections with 6 inch factory applied tape. No substitutions will be considered unless written request for approval has been submitted and approved by the architect no less than ten days prior to the bid date.

2.3 UNDERLAYMENT and OVERLAYMENT BOARD

- A. Insulation underlayment board on metal deck areas shall be ½" Carlisle Securock. Insulation overlayment board shall be minimum 3/8" Carlisle Securock. Boards shall be an impact resistant, non-structural, fiber reinforced gypsum panel manufactured with 95% certified recycle content and moisture and mold resistance throughout the panel core and surface; manufactured to conform to ASTM C1278.

2.4 INSULATION

- A. Flat Insulation areas shall be Carlisle Insulbase polyisocyanurate and shall be minimum R-30 as per 2014 ASTM C1289, (LTTR).
- B. Tapered Insulation and crickets shall be Carlisle Insulbase Polyisocyanurate as supplied by Carlisle SynTec Incorporated (or the membrane manufacturers') as shown on drawings, with a minimum average R value of 30 as per 2014 ASTM C1289, (LTTR). Insulation transitions/step offs greater than ½" will require a transition board such as a wood fiberboard tapered edge strip.
- C. All Polyisocyanurate shall be as per ASTM 1289 Type II, Class 1, Grade 2, 20 PSI minimum.

2.5 VAPOR RETARDER / TEMPORARY ROOF

- A. Vapor retarder is a minimum 40 mil composite sheet consisting of a self-adhering rubberized asphalt membrane. The underlayment board shall be primed with Low VOC Carlisle Cav-Grip in accordance with manufacturer's specifications. Vapor retarder must have a perm rating of 0.05 or less as per ASTM E90. Vapor retarder must be rated by the manufacturer as a temporary roof with an allowable exposure to the elements for 90 days.

2.6 ADHESIVES AND CLEANERS

- A. All products shall be furnished by the membrane manufacturer and specifically formulated for the intended purpose. **All primers and adhesives must comply with NYS VOC OTC regulations.**
1. Bonding Adhesive: Low VOC (**Membrane Adhesive must be manufactured by the Primary membrane manufacturer to ensure compatibility**)
 2. Splice Tape and Primer: Sure-Seal 6 inch SecurTAPE and Low VOC EPDM Primer
 3. Cleaning Solvent: Sure-Seal Weathered Membrane Cleaner
 4. External seam sealant: Sure-Seal Lap Sealant (**To be used on all field and flashing splices.**)
 5. Sealer: Sure-Seal Pourable Sealer
 6. Insulation & Overlayment adhesive: Flexible FAST Adhesive - Insulation adhesive must be V.O.C. free and be a 2 part low rise foam adhesive with 100% adhesion. (**Ribbon method adhesives are acceptable. Bead spacing shall be 4 inches on center in the field, perimeters and corners.**)

2.7 FASTENERS AND PLATES

- A. To be used for mechanical attachment of the underlayment board into the metal deck and to provide additional membrane securement:
1. **HP Fasteners:** a threaded, black epoxy electro-deposition coated fastener used with steel and wood roof decks.
 2. **InsulFast Fasteners:** A threaded #12 fastener with #3 phillips head used for insulation and underlayment board attachment into steel or wood decks.
 3. **Hammer Screw:** an expansion anchor with stainless steel drive pin used for fastening the Sure-Seal Termination Bar or Seam Fastening Plates to concrete, brick, or block walls.
 4. **HP 14-10 Fasteners:** A #14 threaded fastener used for minimum 3,000 psi concrete decks.
 5. **Insulation Fastening Plates:** a nominal 3 inch diameter plastic or metal plate used for insulation attachment in conjunction with HP Fasteners or Concrete Spikes.
 6. **Seam Fastening Plates:** a 2 inch diameter steel, FM approved metal plate used in conjunction with RUSS or with EPDM membrane for membrane securement.
 7. **RUSS (Reinforced Universal Securement Strip):** a 6 or 9 inch wide, 100 foot long strip of reinforced EPDM membrane.
 - a. The **6 inch wide RUSS** shall be utilized horizontally or vertically (in conjunction with Seam Fastening Plates) below the EPDM membrane for additional membrane securement.
 - b. The **9 inch wide RUSS** shall be utilized in conjunction with metal edgings to allow the continuation of the EPDM deck membrane as flashing at all corner areas (20 foot in each direction) in accordance with details.

2.8 METAL EDGING AND MEMBRANE TERMINATIONS

- A. All metal edging shall be Factory Mutual Approved. All wood blocking shall be installed as per FM 1-49.
- B. **METAL EDGE QUALITY ASSURANCE:** High performance gravel stop shall be CERTIFIED by the gravel stop manufacturer to comply with ANSI/SPRI Standard ES-1-98. Roof edge/gravelstop shall meet performance design criteria according to the following test standards:

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1. ANSI/SPRI ES-1-98 Test Method RE-1 Test for Roof Edge Termination of Single-ply Roofing Membranes: The fascia system shall be tested to secure the membrane to minimum 100 lbs/ft in accord with the ANSI/SPRI ES-1-98 Test Method RE-1. Use the current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
2. ANSI/SPRI ES-1-98 Test Method RE-2 Pull-Off Test for Fascia: The fascia system shall be tested in accord with the ANSI/SPRI ES-1-98 Test Method RE-2. Use the current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
3. FMRC Loss Prevention Data Sheet 1-49 "Perimeter Flashing." The fascia product shall be listed in current Factory Mutual Research Corporation Approval Guide.

C. **SecurEdge 2000 Fascia / Gravel Stop:** a snap-on edge system consisting of an extruded aluminum base anchor and .050" aluminum fascia. Installed as per Carlisle detail U-1C similar with 6 inch seam tape. Color chosen by owner from standard color range.

D. **SecurEdge 300 Coping:** incorporates a 20 gauge anchor cleat with 4 pre-slotted holes, a concealed joint cover and 10 foot continuous sections of coping cap; can accommodate minimum 5 inch wide parapet walls. Metal coping shall be .050 aluminum and the color shall be a standard Kynar color or as noted on drawings. **The required metal edge detail for this project shall be Carlisle Detail U-9F.**

E. **Termination Bar:** a 1 inch wide and .098 inch thick extruded aluminum bar pre-punched 6 inches on center; incorporates a sealant ledge to support Lap Sealant and provide increased stability for membrane terminations. **The required metal edge detail for this project shall be Carlisle Detail U-9A.**

F. **Fascia / drip edge:** an edge system consisting of a 26 gauge galvanized metal wind cleat and .050 inch thick aluminum fascia. **The required metal edge detail for this project shall be Carlisle Detail U-1D.1 Option 1.**

G. **Wood blocking to be installed as per FM 1-49.**

2.9 WALKWAYS

- A. Protective surfacing for roof traffic shall be Sure-Seal Walkway Pads (30" x 30" molded black rubber with factory rounded corners) adhered to the EPDM membrane roof with Splice Tape.

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with the manufacturer's published instructions for the installation of the membrane roofing system including proper substrate preparation, jobsite considerations and weather restrictions. All roofing products must be installed complete each day. Phased applications are not acceptable.
- B. Position sheets to accommodate contours of the roof deck and shingle splices to avoid bucking water.

3.2 UNDERLAYMENT BOARD ATTACHMENT ON METAL DECK AREAS ONLY

- A. Mechanically attach the 1/2" Carlisle Securock to meet the required uplift ratings but no less than one fastener per 2 square feet in the field and perimeter of the roof system and one per 1 square foot in the corners. **Mechanically fasten the underlayment board thru the top flutes only careful not to penetrate the low flutes.**

3.3 VAPOR BARRIER APPLICATION

- A. Surfaces to receive Carlisle 725 TR Air and Vapor Barrier must be clean and dry. Blow off and broom off any loose debris. Prime all surfaces to receive the vapor retarder with a NYS VOC OTC compliant primer, Low VOC CCW-702 Primer or Cav-Grip. Apply the primer with a long nap roller at the

applicable coverage rate noted above. At 75° F allow primer to dry 1 hour minimum. If the Cav-Grip is being used; spray apply in a thin even coat at a rate of 2,000 - 2,500 square feet per cylinder. Apply Cav-Grip in a thin, even coat to substrate. Avoid high thickness buildup. Keep spray gun perpendicular to surface during spray. Set time for the Cav-Grip should be approximately 5 minutes. Primers have a satisfactory cure when it will not transfer when touched. Prime only areas to be waterproofed the same day. Reprime if area becomes dirty. Apply Carlisle 725TR Air and Vapor Barrier from low to high point, in a shingle fashion, so that laps will shed water. Overlap all edges at least 2-1/2 inches. End laps shall be staggered. Place membrane carefully so as to avoid wrinkles and fishmouths. Immediately after installation, roll with a 100-150 pound weighted steel roller. There shall be no gaps in the vapor barrier application.

3.4 INSULATION and OVERLAYMENT BOARD ATTACHMENT

- A. Secure all insulation, staggering all joints, to the Vapor Retarder with the Flexible FAST Adhesive in accordance with the manufacturer's specifications and application procedures. Insulation adhesive must be a 2 part low rise foam adhesive with 100% adhesion. Apply the overlayment board with the same adhesive application requirements. **(Ribbon method adhesives are acceptable. Bead spacing shall be 4 inches on center in the field, perimeters and corners.) Strict care must be taken to make sure that all insulation and cover boards lay flat and are in an even plane with adjacent boards.** **(Caution: Do not apply urethane adhesives to unweathered asphalt, new or residual.)**
1. Allow Flexible FAST adhesive to rise approximately 1/8" and develop a string/body (approximately 1.5-2 min). String time will vary based on environmental conditions like temperature and humidity. String time is measured by touching the adhesive with a splice wipe and looking for development of "strings" of adhesive as you pull the splice wipe out of the adhesive. Do not allow the adhesive to over-cure prior to setting the roof boards.
 2. When installing full spray or beads do not allow the foam installation pattern to exceed the width of the board being installed. Exceeding the width of the roof board will cause an uneven application of the adjacent board due to the rising foam. (See Carlisle Detail A-27G for 4" bead spacing.)
 3. Walk the boards into the adhesive **and** roll using a 30" wide, 150 pound weighted steel roller to ensure full embedment. Optimal set up time should be approximately 5 to 7 minutes. (Caution: walking on the boards immediately after placement in adhesive can cause slippage/movement until the adhesive has started to set. When walking the boards in, relief cuts may be necessary to allow a lifted board to lay flat, constant weight may be required to achieve adequate adhesion.

3.5 MEMBRANE PLACEMENT AND BONDING

- A. Unroll and position membrane without stretching. Allow the membrane to relax for approximately 1/2 hour before bonding. Fold the sheet back onto itself so half the underside of the membrane is exposed.
- B. Apply the Bonding Adhesive in accordance with the manufacturer's published instructions, to both the underside of the membrane and the substrate. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.
 1. Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded half of the membrane sheet with a soft bristle push broom to achieve maximum contact.
 2. Fold back the unbonded half of the membrane sheet and repeat the bonding procedure.
- C. Install adjoining membrane sheets in the same manner, overlapping edges approximately 7 inches. Do not apply bonding adhesive to the splice area.
- D. Strict care must be taken to make sure that bonding adhesive and bonding adhesive can stains are prevented on the finished roof membrane. Any short or long term storage of metal containers that can rust will require a separator sheet on the finished roof membrane.

3.6 MEMBRANE SPLICING: 6 inch pre-applied Splice Tape is required for this project: All details and splice procedures as per 25 & 30 Year Warranty specifications, no exceptions or deviations.

- A. Overlap adjacent sheets and mark a line 1/2 inch out from the top sheet.
- B. Fold the top sheet back and clean the dry splice area (minimum 6 inches wide) of membrane with Sure-Seal Primer as required by the membrane manufacturer.
- C. Apply Primer to the EPDM sheet. Press Membrane and tape onto the sheet using hand pressure.
- D. Remove the release film and press the top sheet onto the tape using hand pressure.
- E. Roll the seam toward the splice edge with a 2 inch wide steel roller.
- F. Splice intersections are to be overlaid with a layer of 6" X 6" **and** a 12" X 12" Pressure-Sensitive flashing.
- G. **All field and flashing splices are to be sealed with Lap Sealant and installed per Carlisle detail U-2A.1, option 2.**

3.7 FLASHING

- A. Wall and curb flashing shall be cured EPDM membrane. Continue the deck membrane as wall flashing where practical. All outside corners shall be as per Carlisle detail U-15G.1.
- B. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.
- C. The fascia edge detail must be installed in accordance with Carlisle detail U-1C.
- D. All wall terminations shall be as per Carlisle Detail U-9A.
- E. Base wall flashing shall be as per Carlisle Detail U-2C.

3.8 WALKWAYS

- A. Install walkways at all traffic concentration points (such as roof hatches, access doors, rooftop ladders, etc.) and all locations as identified on the specifier's drawing.
- B. Adhere walkways pads to the EPDM membrane in accordance with the manufacturer's specifications.

3.9 DAILY SEAL

- A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.
- B. Use Sure-Seal Pourable Sealer or other acceptable membrane seal in accordance with the manufacturer's requirements.

3.10 CLEAN UP

- A. Perform daily clean-up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.
- B. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.

END OF SECTION 075323

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SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manufactured Products:
 - a. Manufactured reglets.
 - 2. Formed Products:
 - a. Formed miscellaneous flashings.

1.2 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Metal Edge Securement: Install in accordance with ANSI/SPRI ES-1, "American National Standard for Edge Systems Used with Low-Slope Roofing Systems."
- C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Identification of material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 4. Details of termination points and assemblies, including fixed points.
 - 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
 - 6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 - 7. Details of special conditions.
 - 8. Details of connections to adjoining work.
- C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.
- D. Qualification Data: For qualified fabricator.

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- E. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.
- F. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.6 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 SHEET METALS**

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Surface: Smooth, flat.
 - 2. Exposed Coil-Coated Finishes:
 - a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3. Color: As selected by Architect from manufacturer's full range.

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4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.
- C. Stainless-Steel Sheet: ASTM A 240 or ASTM A 666, Type 304, dead soft, fully annealed.
 1. Finish: 2D (dull, cold rolled).
 2. Surface: Smooth, flat.
- D. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.
 1. Source Limitations: Obtain sheet from single source from single manufacturer.
 2. Non-patinated, Exposed Finish: Mill.
 3. **16 oz./sq. ft.**
- E. Lead Sheet: ASTM B749 lead sheet

2.2 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- B. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- C. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - b. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 2. Fasteners for Zinc-Tin Alloy-Coated Copper Sheet: Copper, hardware bronze or Series 300 stainless steel.
 3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Solder:

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1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
 2. For Copper: ASTM B 32, 100 percent tin with a maximum lead content of 0.2 percent.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Fry Reglet Corporation; **Springlock Flashing System** or a comparable product by one of the following:
 - a. Cheney Flashing Company.
 - b. Heckmann Building Products, Inc.
 - c. Metal-Era, Inc.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
1. Formed Aluminum: 0.040 inch thick.
 2. Corners: Factory mitered and mechanically clinched and sealed watertight.
 3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge. For use only where masonry type reglet is not suitable.
 4. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
- C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:
1. Formed Aluminum: 0.040 inch thick.
- D. Aluminum Finish: Manufacturer's standard polyester paint finish, gray.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

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2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- G. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- H. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - 5. Install sealant tape where indicated.
 - 6. Torch cutting of sheet metal flashing and trim is not permitted.
 - 7. Do not use graphite pencils to mark aluminum surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - 1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection.
- D. Fastener Sizes: Use fasteners of sizes as follows:
 - 1. Penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws
 - 2. Penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints as shown and as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Do not solder metallic-coated steel and aluminum sheet.
 - 2. Pre-tinning is not required for zinc-tin alloy-coated copper.

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3. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 4. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- G. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 04 Section "Unit Masonry."
- C. Reglets: Installation of reglets is specified in Division 04 Section "Unit Masonry."
- D. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.

3.6 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Roof-edge flashings.
 2. Pre-manufactured aluminum roof ladders.

1.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. FM Approvals' Listing: Manufacture and install roof-edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.
- C. SPRI Wind Design Standard: Manufacture and install roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:
1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for roof-edge flashings.
- D. Maintenance Data: For roofing specialties to include in maintenance manuals.
- E. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.
 2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.6 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 ROOF-EDGE FLASHINGS**

- A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet cant, 0.028 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco **TremLock™ Fascia** or a comparable product by one of the following:
 - a. Hickman Company, W. P.
 - b. Metal-Era, Inc.
 - 2. Products must qualify to be included under the Tremco full system warranty
 - 3. Fascia Cover: Fabricated from the following exposed metal:
 - a. Kynar/Hylar coated aluminum, 0.050 thickness.
 - 4. Corners: Factory mitered and mechanically clinched and sealed watertight.
 - 5. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
 - 6. Face dimensions as indicated on drawings.
 - 7. Two coat Kynar 500/Hylar 5000 color to be selected from manufacturer's standard color chart.

2.2 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

2.3 ALUMINUM LADDERS

- A. Low parapet access ladder: Manufactured, tubular rail aluminum access ladder with platform.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide O'Keeffe's aluminum ladder with platform, Model 503A or a comparable product by one of the following:
 - 1. Precision Ladders, LLC

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- 2. Alaco Ladder Company
- 3. Jomy
- C. Rails and rungs: extruded aluminum.
- D. Top platform: 1" x 3" x 1/8" minimum channel frame with 1 1/4" minimum grate platform surface.
- E. Supports: 3/16" minimum aluminum wall brackets – ladder primary support must be by wall brackets.
- F. Finish: Powder coat selected from manufacturer's standard color chart (OSHA safety colors).

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153 or ASTM F 2329.
- C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply

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in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark aluminum surfaces.
- 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. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhering, high-temperature sheet underlayment.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes as follows:
 - 1. Penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 - 2. Penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints with elastomeric sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.4 ROOF-EDGE FLASHING INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.5 LADDER INSTALLATION

- A. Install ladders in configurations and at locations indicated on Drawings. Provide clearances from building elements as recommended by the manufacturer, and complying with OSHA standards.
- B. Prior to installation verify that the substrates are structurally sound, solid, clean, and ready to accept required fasteners.

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- C. Use Manufacturer-supplied brackets and fasteners as recommended by the ladder Manufacturer.

3.6 CLEANING AND PROTECTION

- A. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- B. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY**A. Section Includes:**

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Mildew-resistant joint sealants.
4. Urethane joint sealants.
5. Latex joint sealants.

1.2 ACTION SUBMITTALS

- A. Product Data:** For each joint-sealant product.
- B. Samples for Initial Selection:** Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule:** Include the following information:
1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data:** For qualified testing agency.
- B. Product Test Reports:** For each kind of joint sealant, for tests performed by a qualified testing agency.
- C. Field-Adhesion-Test Reports:** For each sealant application tested.
- D. Sample Warranties:** For special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:** An authorized representative who is trained and approved by manufacturer.
- B. Product Testing:** Test joint sealants using a qualified testing agency.
1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.5 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:**
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.

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2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty for Silicone Sealants: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Twenty years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS**2.1 JOINT SEALANTS, GENERAL**

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. Dow Corning Corporation; DOW CORNING® 795 SILICONE BUILDING SEALANT.

2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. Dow Corning Corporation; DOW CORNING® 790 SILICONE BUILDING SEALANT

2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. Sika Corporation; Joint Sealants; Sikaflex 15LM.

2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 786 Silicone Sealant
 - b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS 1700.
 - c. Tremco Incorporated; Tremsil 200.

2.6 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. Pecora Corporation; AC-20.
 - b. Tremco Incorporated; Tremflex 834.

2.7 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

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- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 3. Remove laitance and form-release agents from concrete.

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4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- 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 allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs 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.

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3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL**A. Field-Adhesion Testing:** Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 5 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.**3.5 CLEANING**

- A.** Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precast architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints in exterior insulation and finish systems.
 - e. Joints between different materials listed above.
 2. Joint Sealant: Silicone, nonstaining, S, NS, 100/50, T, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Joints between metal panels.
 - b. Joints between aluminum framing components.
 - c. Perimeter joints between building materials and frames of doors windows and louvers.
 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces where painting is required
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
 - c. Vertical joints on exposed surfaces of unit masonry concrete walls and partitions.
 2. Joint Sealant: Urethane, S, NS, 100/50, T, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement and scheduled for painting.
1. Joint Sealant: Acrylic latex.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

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- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Countertops
 - d. Other joints as indicated on Drawings.
 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

ITEM 627.0008 25**OPENINGS****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.
- 1.02 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0008 25**OPENINGS****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

- A. Section 081113 HOLLOW METAL DOORS AND FRAMES
- B. Section 085113 ALUMINUM WINDOWS
- C. Section 087100 DOOR HARDWARE

1.02 This item shall include, but not be limited to, the following:

- A. New doors and windows and associated hardware for the addition to the existing building.

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
1. Interior standard steel doors and frames.
 2. Exterior standard steel doors and frames.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include the following:
1. Elevations of each door type.
 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
- C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Field quality control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ceco Door; ASSA ABLOY.
 2. Curries Company; ASSA ABLOY.
 3. Pioneer Industries.
 4. Republic Doors and Frames.
 5. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. (2.84 W/K x sq. m) when tested according to ASTM C518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard.
 - f. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.
 - 2. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - b. Construction: Full profile welded.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. At locations indicated in the Door and Frame Schedule.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A60 (ZF180) coating.

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- d. Edge Construction: Model 2, Seamless.
 - e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - f. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - g. Core: Polyurethane or Polyisocyanurate.
2. Frames:
- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum A60 (ZF180) coating.
 - b. Construction: Full profile welded.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
- 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
 - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
- 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Glazing: Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- H.

2.7 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 - 2. Fire-Rated Openings: Install frames according to NFPA 80.
 - 3. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 4. Solidly pack mineral-fiber insulation inside frames.
 - 5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
 - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

- d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- B. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors according to NFPA 105.
- C. Glazing: Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

3.3 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes fixed and operable aluminum-framed windows for exterior locations.

1.2 DEFINITIONS

- A. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:
1. AW: Architectural.
 2. HC: Heavy Commercial.
 3. C: Commercial.
 4. LC: Light Commercial.
 5. R: Residential.
- B. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:
1. Design pressure number in pounds force per square foot used to determine the structural test pressure and water test pressure.
- C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
- D. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:
1. Size required by AAMA/WDMA 101/I.S.2/NAFS for gateway performance.
- B. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:
1. Mullion details, including reinforcement and stiffeners.
 2. Joinery details.
 3. Expansion provisions.
 4. Flashing and drainage details.
 5. Weather-stripping details.

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6. Thermal-break details.
 7. Glazing details.
 8. Window cleaning provisions.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
1. Include similar Samples of hardware and accessories involving color selection.
- D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.
- E. Qualification Data: For Installer.
- F. Maintenance Data: For operable window sash, operating hardware, weather stripping and finishes to include in maintenance manuals.
- G. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.
- B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.
- C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Do not modify size and dimensional requirements.
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Preinstallation Conference: Conduct conference at Project site.
- F. Test reports shall be accompanied by the window manufacturer's letter of certification, stating the tested window meets or exceeds the referenced criteria for the appropriate window type.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.

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- c. Faulty operation of movable sash and hardware.
- d. Deterioration of metals, other materials, and metal finishes beyond normal weathering.
- e. Failure of insulating glass.
- 2. Warranty Period:
 - a. Window: Ten years from date of Substantial Completion.
 - b. Glazing: Ten years from date of Substantial Completion.
 - c. Metal Finish: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, not less than 16,000-psi minimum yield strength, and not less than 0.062-inch thickness at any location for the main frame and sash members.
- B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
 - 1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
 - 2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.
 - 1. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
 - 2. Configuration: Bulb- or fin-type at exterior vent member; fin-type at interior.
- F. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
 - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
- G. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.
- H. Thermal Barrier:

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1. All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is defined as a system that shall transfer shear during bending and therefore, promote composite action between the exterior and interior extrusions.
2. The thermal barrier shall be thermal struts, consisting of glass reinforced polyamide nylon, mechanically crimped in raceways extruded in the exterior and interior extrusions.
3. Poured and debridged urethane thermal barriers shall not be permitted.

2.2 WINDOWS**A. Window Type: Fixed Windows.**

1. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.
2. Basis-of-Design Product: Subject to compliance with requirements, provide "Series FX32 Thermal AW-PG150-FW fixed" by EFCO or a comparable product by one of the following:
 - a. EFCO Corporation.
 - b. Graham Architectural Products Corp.
 - c. Kawneer; an Alcoa Company.
 - d. TRACO.
 - e. Wausau Window and Wall Systems.
3. Laboratory Testing and Performance Requirements
 - a. Test Units
 - 1) Air, water, and structural test unit shall conform to requirements set forth in AAMA/WDMA/CSA 101/I.S.2/A440 – 17 and manufacturer's standard locking/operating hardware and insulated glazing configuration.
 - 2) Thermal test unit sizes shall be 24" (610 mm) x 60" (1524 mm).
 - b. Test Procedures and Performances
 - 1) Windows shall conform to all AAMA/WDMA/CSA 101/I.S.2/A440-17 requirements for window performance class AW. In addition, the following specific performance requirements shall be met.
 - 2) Air Infiltration Test
 - a) Test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf (299 Pa).
 - b) Air infiltration shall not exceed .30 cfm/SF (.50 l/s•m²) of unit.
 - 3) Water Resistance Test
 - a) Test unit in accordance with ASTM E 331/ASTM E 547 at a static air pressure difference of 15.0 psf (720 Pa).
 - b) There shall be no uncontrolled water leakage.
 - 4) Uniform Load Deflection Test
 - a) Test unit in accordance with ASTM E 330 at a static air pressure difference of 225.0 psf (10800 Pa), positive and negative pressure.
 - b) No member shall deflect over L/175 of its span.
 - 5) Uniform Load Structural Test
 - a) Test unit in accordance with ASTM E 330 at a static air pressure difference of 240.0 psf (11,491 Pa), both positive and negative.
 - b) At conclusion of test there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, nor any other damage that would cause the window to be inoperable.

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- 6) Condensation Resistance Test (CRF)
 - a) Test unit in accordance with AAMA 1503.1.
 - b) Condensation Resistance Factor (CRF) shall not be less than 73 (frame) when glazed with .24 center of glass U-Factor.
- 7) Thermal Transmittance Test (Conductive U-Factor)
 - a) Test unit in accordance with NFRC 100-2010.
 - b) Conductive thermal transmittance (U-Factor) shall not be more than .33 BTU/hr•ft²•°F when glazed with .24 center of glass U-Factor.

B. Window Type: Slider Windows.

1. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.
2. Basis-of-Design Product: Subject to compliance with requirements, provide "Series 3500 Thermal AW-PG55-HS Horizontal Sliding by EFCO or a comparable product by one of the following:
 - a. EFCO Corporation.
 - b. Graham Architectural Products Corp.
 - c. Kawneer; an Alcoa Company.
 - d. TRACO.
 - e. Wausau Window and Wall Systems.
3. Laboratory Testing and Performance Requirements
 - a. Test Units
 - 1) Air, water, and structural test unit shall conform to requirements set forth in AAMA/WDMA/CSA 101/I.S.2/A440-08 and manufacturer's standard locking/operating hardware and insulated glazing configuration.
 - 2) Thermal test unit sizes shall be 72" (1828 mm) x 48" (1219 mm). Unit shall consist of a single horizontal sliding window.
 - b. Test Procedures and Performances
 - 1) Windows shall conform to all AAMA/WDMA/CSA 101/I.S.2/A440-08 requirements for window performance class AW. In addition, the following specific performance requirements shall be met.
 - c. Life Cycle Testing
 - 1) Test in accordance with AAMA 910. There shall be no damage to fasteners, hardware parts, support arms, activating mechanisms, or any other damage that would cause the window to be inoperable. Air infiltration and water resistance tests shall not exceed specified requirements.
 - d. Air Infiltration Test
 - 1) With ventilators closed and locked, test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf (299 Pa).
 - 2) Air infiltration shall not exceed .10 cfm/SF (.50 l/s•m²) of unit.
 - e. Water Resistance Test
 - 1) With ventilators closed and locked, test unit in accordance with ASTM E 331/ASTM E 547 at a static air pressure difference of 12.0 psf (575 Pa).
 - 2) There shall be no uncontrolled water leakage.
 - f. Uniform Load Deflection Test
 - 1) With ventilators closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 50 psf (2394 Pa), positive and negative pressure.

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- 2) No member shall deflect over $L/175$ of its span.
- g. Uniform Load Structural Test
 - 1) With ventilators closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 82.5 psf (3591 Pa), both positive and negative.
 - 2) At conclusion of test there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, nor any other damage that would cause the window to be inoperable.
- h. Forced Entry Resistance
 - 1) Windows shall be tested in accordance to ASTM F 588 or AAMA 1302.5 and meet the requirements of performance level 40
- i. Condensation Resistance Test (CRF)
 - 1) Test unit in accordance with AAMA 1503.1.
 - 2) Condensation Resistance Factor (CRF) shall not be less than 60 (frame) when glazed with .024 center of glass U-Factor.
- j. Condensation Resistance (CR)
 - 1) With ventilators closed and locked, test unit in accordance with NFRC 500-2010.
 - 2) Condensation Resistance (CR) shall not be less than 37 when glazed with 0.24 center of glass U-Factor.
- k. Thermal Transmittance Test (Conductive U-Factor)
 - 1) With ventilators closed and locked, test unit in accordance with NFRC 100-2010.
 - 2) Conductive thermal transmittance (U-Factor) shall not be more than .46 BTU/hr•ft²•°F (2.61 W/m²•K) when glazed with 0.24 center of glass U-Factor.
- C. Hardware
 - 1. Concealed plunger lock in the meeting rail with a flush mounted actuating handle.
 - 2. Sash shall ride on steel ball bearing rollers and a raised track, so dirt will not interfere with normal operation.
- D. Weather-Strip
 - 1. All primary weather-strip shall be E-lon or equal.
- E. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/ WDMA 101/ I.S.2/ NAFS for operating window types indicated.
- F. Project Wind Loads
 - 1. The system shall be designed to withstand the following loads normal to the plane of the wall:
 - a. Positive pressure of 25 psf
 - b. Negative pressure of 25 psf

2.3 GLAZING

- A. Glass Type Low-E-coated, clear insulating glass.
 - 1. Basis-of-Design Product: Guardian SN 68 / IS 20 Unit
 - 2. Overall Unit Thickness: 1 inch.
 - 3. Minimum Thickness of Outdoor Lite: 6 mm.
 - 4. Outdoor Lite: Sun Guard SN68 on Clear Tempered.

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5. Interspace Content: Argon.
6. Indoor Lite: Sun Guard IS 20 on Clear laminated glass with two plies of heat-strengthened float glass.
 - a. Minimum Thickness of Each Glass Ply: 3 mm.
 - b. Interlayer Thickness: 0.030 inch.
7. Low-E Coating: Second and Sixth surface.
8. Winter Nighttime U-Factor: 0.20 maximum.
9. Summer Daytime U-Factor: 0.22 maximum.
10. Visible Light Transmittance: 68 percent minimum.
11. Solar Heat Gain Coefficient: 0.36 maximum.
12. Safety glazing required.

2.4 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows, and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals. Where exposed, provide extruded, cast, or wrought aluminum, die-cast zinc with special coating finish, or nonmagnetic stainless steel. Also as specified in 1.10 above.
- B. Limit Devices: Provide limit devices designed to restrict sash or ventilator opening.
 1. Safety Devices: Limit clear opening to 6 inches for ventilation; with custodial key release.

2.5 INSECT SCREENS

- A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on inside or outside dependent on window type of window and provide for each operable exterior sash or ventilator.
 1. Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," for minimum standards of appearance, fabrication, attachment of screen fabric, hardware, and accessories unless more stringent requirements are indicated.
- B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
 1. Extruded-Aluminum or Aluminum Tubular Framing Sections and Cross Braces: Not less than 0.050-inch wall thickness.
 2. Finish: Match aluminum window members.
- C. Aluminum Wire Fabric: 18-by-16 mesh of 0.011-inch- diameter, coated aluminum wire.
 1. Wire-Fabric Finish: Black.
- D. Wickets: Provide sliding or hinged wickets, framed and trimmed for a tight fit and for durability during handling.

2.6 ACCESSORIES

- A. Provide manufacturer's standard subframe and subsill components with integral vapor barrier flanges and extended snap-on exterior trim for both fixed and operable windows.

2.7 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
- C. All aluminum frame extrusions shall have a minimum wall thickness of .080" (3mm).
- D. Mechanical fasteners, welded components, and hardware items shall not bridge thermal barriers. Thermal barriers shall align at all frame corners.
- E. Depth of frame and vent shall not be less than 3 1/4" (82mm).
- F. All frame members shall be able to accommodate separate interior and exterior finishes and colors.
- G. Frame components shall be mechanically fastened.
- H. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
 - 1. Vertically Pivoted Windows: Provide double-row weather stripping.
- I. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- J. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
- K. All units shall be glazed with the manufacturer's standard sealant process provided the glass is held in place by a removable, extruded aluminum, glazing bead. The glazing bead must be isolated from the glazing material by a gasket.
- L. All units shall be glazed with a minimum of 9/16" glass bite.

2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- A. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from custom color selection.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
 - 1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 - 2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches of opening.
 - 3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
- D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.

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1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
 1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, Test Method A or B, by applying same test pressures required to determine compliance with AAMA/WDMA 101/I.S.2/NAFS in Part 1 "Performance Requirements" Article.
- C. Remove and replace noncomplying aluminum window and retest as specified above.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- E. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08 5113

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
- C. Related Sections:
 - 1. Division 08 Section “Hollow Metal Doors and Frames”.
- 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. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series
 - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.2 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.

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- 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. 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.
- F. 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, Operation and Maintenance Data.

1.3 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. 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.
- C. 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.
- D. 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.
 - E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
 - F. Keying Conference: Conduct a conference with the Owner to finalize keying requirements and obtain final instructions in writing. 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.

1.4 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".

1.5 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.

1.6 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. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Ten years for mortise locks and latches.
 - 2. Five years for exit hardware.
 - 3. Twenty five years for manual surface door closer bodies.
 - 4. Two years for electromechanical door hardware.

1.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 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:
- C. 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.
- D. 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.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
 - 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 where indicated in the Hardware Sets or on Drawings:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 5. Acceptable Manufacturers:
 - a. Stanley (ST).
 - b. Hager Companies (HA).
 - c. McKinney Products (MK).
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 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. Acceptable Manufacturers:
 - a. Stanley (ST).
 - b. McKinney Products (MK).
 - c. Pemko Manufacturing (PE).

2.3 DOOR OPERATING TRIM

- A. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls 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. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 3. Acceptable Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).

2.4 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.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
 - 1. Acceptable Manufacturers:
 - a. Best – 6 pin interchangeable core
- C. Cylinders: Original manufacturer cylinders complying with the following:
 - 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 - 4. 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.
 - 5. Keyway: Coordinate with owner.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Conduct specified "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.
- E. 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 Control Keys (where required): Two (2).
 - 4. Permanent Control Keys (where required): Two (2).
- F. Construction Keying: Provide temporary keyed construction cores.
- G. 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.

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
 - 1. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.13 requirements to 10 million cycles.
 - 2. Acceptable Manufacturers:
 - a. Stanley Best 45H series
 - b. Corbin Russwin Hardware (RU) – ML2000 Series.
 - c. Schlage (SC) – L9000 Series.
- B. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified cylindrical (bored) locksets furnished in the functions as specified in the Hardware Sets. Lock chassis fabricated of heavy gauge steel, zinc dichromate plated, with through-bolted

application. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt. Locks are to be non-handed and fully field reversible.

1. Acceptable Manufacturers:
 - a. Stanley Best 9K series
 - b. Corbin Russwin Hardware (RU) – CL3100 Series.
 - c. Schlage (SC) – ND Series Series.

2.6 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 A156.5.
 4. Dustproof Strikes: BHMA A156.16.

2.7 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 1. 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.
 2. 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.
 3. 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.
 4. 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.
 5. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.

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. Extended cycle test: Devices to have been cycle tested in ordinance with ANSI/BHMA 156.2 requirements to 9 million cycles.
 11. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 12. 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 panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, Pullman type, with deadlock feature.
1. Acceptable Manufacturers:
 - a. Stanley Precision (PR) - Apex 2000 Series.
 - b. Corbin Russwin Hardware (RU) - ED5000 Series.
 - c. Sargent Manufacturing (SA) - 80 Series.
- C. Extruded Aluminum Removable Mullions: ANSI/BHMA A156.3 anodized, removable mullions with malleable-iron top and bottom retainers. Mullions to be provided standard with stabilizers and imbedded weatherstrip.
1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) – 808 Series.
 - b. Sargent Manufacturing (SA) - 650A Series.

2.8 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 including installation and adjusting information on inside of cover.
 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. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
 4. 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 physically handicapped, provide units complying with ANSI ICC/A117.1.
 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt and security type fasteners as required for proper installation.
- B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 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 body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.
1. Acceptable Manufacturers:
 - a. Stanley D4550/D-4551 Series
 - b. LCN Closers (LC) - 4040XP Series.
 - c. Corbin Russwin (RU) – 6000 Series.
 - d. Sargent Manufacturing (SA) - 281 Series.

2.9 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 certified 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. Acceptable Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).

2.10 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 UBC 7-2, 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. Acceptable Manufacturers:
 - 1. National Guard Products (NG).
 - 2. Pemko Manufacturing (PE).
 - 3. Reese Enterprises, Inc. (RE).

2.11 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.

2.12 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

3.1 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.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 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. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 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. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. 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.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 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.

3.6 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.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 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

Hardware Schedule

Set: 1

3	Hinges	FBB 199 4 ½" x 4 ½" NRP	32D	Stanley
1	Closer	D-4550 HCS	689	Stanley
1	Exit Device	2108 X 4908A CD	626	Precision
1	Electric Strike	BES 0162	626	Best
1	Threshold	<u>253x3AFG Pemkote MSES25SS</u>		Pemko
1	Gasketing	303CS		Pemko
1	Sweep	<u>3452CNB TKSP8</u>		Pemko

Set: 2

3	Hinges	FBB 179 4 ½" x 4 ½"	26D	Stanley
1	Classroom Lockset	9K3-7R15D S3	626	Best
1	Wall Stop	409	612	Rockwood
1	Closer	D-4550 H	689	Stanley

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Set: 3

1	Continuous Hinge	FULL MORTISE, AL, GEARED	26D	Stanley
1	Passage Lockset	9K3-0N15D S3	626	Best
1	Closer	D-4550	689	Stanley
1	Wall Stop	409	612	Rockwood

END OF SECTION 087100

ITEM 627.0009 25**FINISHES****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.
- 1.02 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0009 25**FINISHES****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

- A. Section 092216 NON-STRUCTURAL METAL FRAMING
- B. Section 092900 GYPSUM BOARD
- C. Section 093000 TILING
- D. Section 095113 ACOUSTICAL PANEL CEILINGS
- E. Section 096513 RESILIENT BASE AND ACCESSORIES
- F. Section 096519 RESILIENT TILE FLOORING
- G. Section 099113 EXTERIOR PAINTING
- H. Section 099123 INTERIOR PAINTING
- I. Section 099600 HIGH-PERFORMANCE COATINGS SPECIALTIES

1.02 This item shall include, but not be limited to, the following:

- A. Surface Preparation for Priming & Painting
- B. Paint Primer & Finish Coatings
- C. Acoustical Panel Ceilings and other Tiling

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For dimpled steel studs and runners, firestop tracks, from ICC-ES.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- C. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.0312 inch (30mil)
 - b. Depth: As indicated on Drawings.
 2. Dimpled Steel Studs and Runners:
 - a. Base-Metal Thickness and Yield Strength required to achieve structural performance equivalent to 30 mil, 33 KSI standard studs
 - b. Depth: As indicated on Drawings.
- D. Slip-Type Head Joints: Where indicated, provide one of the following:

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1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
 - b. Grace Construction Products; FlameSafe FlowTrak System.
 - c. Metal-Lite, Inc.; The System.
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 0.027 inch.
- G. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
1. Depth: As indicated on Drawings.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.033 inch.
 2. Depth: As indicated on Drawings.
- I. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical.
- J. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch wide flanges.
1. Depth: As indicated on Drawings.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.
- L. Partial Wall Framing Connection: Connector designed to support out-of-plane loading of cantilevered partial wall systems that are unsupported at the top track.
1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Pony Wall PW36 or comparable product by a current member of the SFIA.
 - a. Minimum Base-Steel Thickness: 0.0966 inch (2.45 mm).

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Postinstalled, expansion anchor.
 - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.
 - 1. Depth: 2 inches.
- E. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Grid System.
 - c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
 - 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.

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- b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
- 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Install to maintain continuity of fire-resistance-rated assembly indicated.
- 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Hangers: 48 inches o.c.
 - 2. Carrying Channels (Main Runners): 48 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Do not attach hangers to steel roof deck.
 - 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

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- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.
 - 3. Partition Closures
 - 4. Identifying and labeling of partitions.
- B. Related Requirements:
 - 1. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
 - 2. Section 093000 "Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.3 QUALITY ASSURANCE

- A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - 2. Apply or install final decoration indicated, including painting and wall coverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

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- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 GYPSUM BOARD, GENERAL

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.
- B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles of Project site.
- C. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Georgia-Pacific Gypsum LLC.
 - 2. National Gypsum Company.
 - 3. USG Corporation.
- B. Hi Abuse Moisture and mold resistant Gypsum Board: ASTM C 1396.
 - 1. Basis of Design Product: Gold Bond® Hi-Abuse XP Gypsum Panel
 - 2. Core: 5/8-inch, Type X.
 - 3. Long Edges: Tapered.
 - 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

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1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; FiberCement BackerBoard.
 - b. James Hardie Building Products, Inc.; Hardiebacker.
 - c. National Gypsum Company, Permabase Cement Board.
 - d. USG Corporation; DUROCK Cement Board.
2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.
- B. Interior Reveals
 1. Manufacturer: Fry Reglet
 2. Product: Snap-in Reveal DRM-Snap-in-375 - 3/8" reveal
 3. Description: A 6063 Aluminum reveal fastened to gypsum board with joint treatment compound finish with snap in finish reveal trim.
 4. Provide in locations as indicated on the drawings.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 1. Interior Gypsum Board: Paper.
 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
 3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Tile Backing Panels:
 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Pecora Corporation; AC-20 FTR.
- D. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Fit gypsum panels around ducts, pipes, and conduits.

2. Where partitions intersect, structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- H. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect. Locate Control Joint over door head as indicated on the drawings at a maximum spacing of 30'.
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. LC-Bead: Use at exposed panel edges.

3.6 PARTITION CLOSURE INSTALLATION

- A. Prepare Joint in accordance with manufacturers installation instructions.
- B. Cut the material lengthwise to fit the opening. Add 1/2" to the length.
- C. Insert the joint material into the closure opening by applying hand pressure. Use a plastic trowel to adjust the final position. Finished position should be slightly recessed from the wall.

3.7 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- C. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
- D. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.8 FIRE AND SMOKE BARRIER IDENTIFICATION

- A. Mark wall above ceiling every 8 feet maximum, once per wall section minimum, with its fire and/or smoke barrier designation.
 - 1. Designations to be marked clearly using die-cut mylar stencils.
 - 2. Characters to be 4" minimum in height of a legible font type.
 - 3. Characters to be marked with bright red spray paint
 - a. Character Designations:
 - 1) One hour fire barrier
 - a) 1FB
 - 2) Two hour fire barrier
 - a) 2FB
 - 3) One hour smoke barrier
 - a) 1SB
 - 4) One hour fire/smoke barrier
 - a) 1FSB
 - 5) Two hour fire/smoke barrier
 - a) 2FSB
 - 6) Smoke Tight Partitions
 - a) ST

3.9 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

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- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ceramic tile.
 - 2. Stone thresholds.
 - 3. Waterproof membrane.
 - 4. Crack isolation membrane.
 - 5. Metal edge strips.
- B. Related Sections:
 - 1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 2. Section 092900 "Gypsum Board" for cementitious backer units.

1.2 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.3 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - 1. Level Surfaces: Minimum 0.42.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
 - 2. Stone thresholds in 6-inch lengths.
 - 3. Metal edge strips in 6-inch lengths.

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1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product, signed by product manufacturer.
- D. Material Test Reports: For each tile-setting and -grouting product.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 - 1. Stone thresholds.
 - 2. Waterproof membrane.
 - 3. Crack isolation membrane.
 - 4. Joint sealants.
 - 5. Cementitious backer units.
 - 6. Metal edge strips.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

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- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.2 TILE PRODUCTS

- A. Products: Refer to Color and Finish Schedule on Drawings I-250 for Manufacturer, Product, and Finish.
- B. Colors and Patterns: As indicated by manufacturer's designations.
- A. Ceramic Floor Tile: Unglazed porcelain tile.
 - 1. **Basis** of Design: Crossville Inc. **COLOR BLOX** Series
 - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
 - 3. Face Size: 11-13/16 by 11-13/16 inches (300 by 300 mm).
 - 4. Size of wall base: nominal 12' x 4" high bullnose trim.
 - 5. Face Size Variation: Rectified.
 - 6. Thickness: 3/8 inch (9.5 mm).
 - 7. Face: Plain with square or cushion edges.
 - 8. Dynamic Coefficient of Friction: Not less than 0.42.
 - 9. Tile Color, Glaze, and Pattern: As selected by Architect from manufacturer's full range.
 - 10. Grout Color: As selected by Architect from manufacturer's full range.
- A. Ceramic Wall Tile Type: Unglazed porcelain tile.
 - 1. **Basis** of Design: Crossville Inc. **COLOR BLOX** Series
 - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.

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3. Face Size: 6 by 6 inches (152 by 152 mm).
4. Face Size Variation: Rectified.
5. Thickness: 3/8 inch (9.5 mm).
6. Face: Plain with square or cushion edges.
7. Dynamic Coefficient of Friction: Not less than 0.42.
8. Tile Color, Glaze, and Pattern: As selected by Architect from manufacturer's full range.
9. Grout Color: As selected by Architect from manufacturer's full range.

2.3 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.
 1. Description: Uniform, fine- to medium-grained white stone with gray veining.
 2. Description: Match Architect's sample.

2.4 ACCESSORY TRIMS

- A. Metal Edge and Trim Strips: (TR) Angle or L-shape, height to match tile and setting-bed thickness, metallic base, designed specifically for ceramic tiling applications; aluminum exposed-edge material.
 1. Products: Schluter
 - a. Jolly profile

2.5 WATERPROOFING AND CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Laticrete International, Inc.; Hydro Ban.
 - b. Custom Building Products; RedGuard.

2.6 SETTING MATERIALS

- A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Laticrete International, Inc.
 - b. MAPEI Corporation.
 - c. Custom Building Products

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2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- B. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Laticrete International, Inc.
 - b. MAPEI Corporation.
 - c. Custom Building Products
 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

2.7 GROUT MATERIALS

- A. Polymer-Modified Tile Grout: ANSI A118.7.
1. Products: Subject to compliance with requirements, provide the basis of design product indicated on the Color and Finish Schedule or the following equivalent products matching the basis of design products, characteristics and color.:
 - a. Laticrete International, Inc.
 - b. MAPEI Corporation.
 - c. Custom Building Products
 2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

2.8 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. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series] exposed-edge material.

2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of 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.

3.2 PREPARATION

- A. Fill 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. For cracks, in concrete substrates for tile floors apply crack suppression membrane installed with specified reinforcement materials and adhesive compounds specifically recommended by tile-setting material manufacturer.
- C. Where indicated, prepare substrates to receive fluid applied waterproofing.
- D. 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.

3.3 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

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- b. Tile floors composed of tiles 8 by 8 inches or larger.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. 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. Ceramic Wall Tile: 1/16 inch.
 - 2. Ceramic Floor Tile: 1/8 inch.
- 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.
- I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 - 1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
 - 2. Do not extend waterproofing or crack isolation membrane under thresholds set in latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on waterproofing or crack isolation membrane with elastomeric sealant.
- J. Metal 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.

3.4 TILE BACKING PANEL INSTALLATION

- A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.7 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove epoxy and latex-portland cement 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 days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.8 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. Tile Installation F122: Thin-set mortar on waterproof membrane; TCA F122.
 - a. Tile Type: As specified
 - b. Thin-Set Mortar: Latex- or Medium-bed, latex- portland cement mortar.
 - c. Grout: Polymer-modified sanded grout.
- B. Interior Wall Installations, Masonry or Concrete:
 - 1. Tile Installation W202: Thin-set mortar; TCA W202.
 - a. Tile Type: As specified.

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- b. Thin-Set Mortar: Latex or Medium-bed, latex- portland cement mortar.
 - c. Grout: Polymer-modified sanded or Polymer-modified unsanded grout.
- C. Interior Wall Installations, Metal Studs or Furring:
 - 1. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA W244.
 - a. Tile Type: As specified.
 - b. Thin-Set Mortar: Latex- portland cement mortar.
 - c. Grout: Polymer-modified sanded or Polymer-modified unsanded grout.
- D. Shower Installations, Concrete Subfloor:
 - 1. Tile Installation B421: Thin-set mortar on bonded waterproof membrane; TCNA B421.
 - a. Tile Type: As specified
 - b. Thin-Set Mortar: Latex- - portland cement mortar.
 - c. Grout: Polymer-modified sanded grout.
 - d. If drain with integrated bonding flange is used, provide TCNA method B422
- E.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including proposed hanger wire anchors.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- C. Samples for Initial Selection: For components with factory-applied color finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Suspended ceiling components.
 2. Structural members to which suspension systems will be attached.
 3. Size and location of initial access modules for acoustical panels.
 4. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 5. Perimeter moldings.
- B. Evaluation Reports: For each acoustical panel ceiling suspension system, from ICC-ES.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.

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2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

- A. Test reports: Manufacturer will provide test certification for minimum requirements as tested in accordance with applicable industry standards and/or to meet performance standards specified by various agencies.
- B. Changes from system: System performance following any substitution of materials or change in assembly design must be certified by the manufacturer.
- C. All ceiling panel cartons must contain UL label for acoustical compliance.
- D. All suspension system cartons must contain UL label for load compliance per ASTM C635.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to Seismic Category C.
 1. Provide manufacturer's approved and tested seismic assembly complying with:
 - a. American Society of Civil Engineers 7-05: Minimum Design Loads for Buildings and Other Structures.
 - b. CISCA: Guidelines for Seismic Restraint Direct Hung Suspended Ceiling Assemblies Seismic Zones 3 & 4.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 2. Smoke-Developed Index: 50 or less.

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- C. 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 ACOUSTICAL PANELS, GENERAL

- A. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
 - 2. Suspension System: Obtain each type from single source from single manufacturer.
- C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- D. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- E. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- F. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS - ACT-1

- A. Basis-of-Design Product: Subject to compliance with requirements, provide "School Zone® Fine Fissured™ #1713" by Armstrong World Industries or comparable product by one of the following:
 - 1. USG Corp.
 - 2. CertainTeed Corp.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - 1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
 - 2. Pattern: C (perforated, small holes)) E (lightly textured).
- C. Fire Classification: Class A.
- D. Color: White.
- E. NRC: Not less than 0.70.
- F. CAC: Not less than 35.
- G. Edge/Joint Detail: Square.

- H. Thickness: 3/4 inch.
- I. Modular Size: 24 by 24 inches.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
 - 1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Postinstalled expansion anchors.
 - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 - d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
 - 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 - 3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 - 4. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.
- F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

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- G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.
- I. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.
- J. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.5 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corp.
 - 3. Chicago Metallic Corporation.
 - 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
 - 1. Structural Classification: Heavy-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Steel or aluminum cold-rolled sheet.
 - 5. Cap Finish: Painted white or flat black to match panel color.
 - 6. Basis of Design: Prelude

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corp.
 - 3. Chicago Metallic Corporation.
 - 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
 - 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 - 3. Outside Corner: Prefabricated corner cap; formed to 90° angle; hemmed edge; size and finish to match wall molding.

2.7 ACOUSTICAL SEALANT

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.
 2. Acoustical Sealant for Concealed Joints:
 - a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
 - b. Pecora Corporation; AIS-919.
 - c. Tremco, Inc.; Tremco Acoustical Sealant.
- B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
 2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.
 3. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

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3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post installed anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Ceiling Perimeter (Seismic Considerations): Install edge moldings (7/8" minimum) and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Tee ends shall be tied together with manufacturer supplied Stabilizer Bars or other approved means to prevent the tees from spreading apart.
 2. Maintain a 3/8" clearance between the ends of the suspension members and the wall. The unattached ends of the suspension members shall rest upon and be free to slide perpendicularly to the perimeter molding.
 3. Alternate Perimeter Attachment: When approved by local code officials install 7/8" edge molding with grid manufacturers Seismic Clip accessory in lieu of stabilizer bars.

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- F. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- G. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - 1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 - 2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 - 3. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
 - 4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 - 5. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
 - 6. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
 - 7. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient molding accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Product Schedule: For resilient base and accessory products.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 90 deg F. Insert temperature, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 90 deg F.

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- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."]

2.2 VINYL BASE

- A. Basis of Design Product: Subject to compliance with requirements, provide Johnsonite "Traditional Wall Base" or a comparable product by one of the following:
1. Armstrong World Industries, Inc.
 2. Nora Systems, Inc.
 3. Roppe Corporation, USA.
- B. Product Standard: ASTM F1861, Type TV (vinyl, thermoplastic).
1. Group: I (solid, homogeneous).
 2. Style and Location:
 - a. Style B, Cove: .
- C. Minimum Thickness: 0.125 inch (3.2 mm).
- D. Height: 4 inches (102 mm).
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed or preformed.
- G. Inside Corners: Job formed or preformed.
- H. Colors and Patterns: As selected by Architect.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B.** Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
1. Adhesives shall have a VOC content of 50 g/L or less.
- C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.

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- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter corners to minimize open joints.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
 - 1. Apply three coat(s).
- E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

Section Includes:

1. Vinyl Composition Floor Tile
2. Luxury Vinyl Floor Tile.
3. Moisture Mitigation Membrane
4. Flooring Protection

1.2 ACTION SUBMITTALS

Product Data: For each type of product.

Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

Samples: Full-size units of each color and pattern of floor tile required.

Samples for Initial Selection: For each type of floor tile indicated.

Samples for Verification: Full-size units of each color and pattern of floor tile required.

Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 QUALITY ASSURANCE

Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

2. Build mockups for floor tile including resilient base and accessories.

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- a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.
 - 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.
- B. All flooring types and colors to be furnished for this project shall be from the same production run and dye lot.

1.6 DELIVERY, STORAGE, AND HANDLING

Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.7 FIELD CONDITIONS

Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 90 deg F, in spaces to receive floor tile during the following time periods:

- 1. 48 hours before installation.
- 2. During installation.
- 3. 48 hours after installation.

After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 90 deg F.

Close spaces to traffic during floor tile installation.

Close spaces to traffic for 48 hours after floor tile installation.

Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

- 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore certification.

Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing

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and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 VINYL COMPOSITION FLOOR TILE

Basis of Design: ARMSTRONG Excelon

Thickness: 1/8- inch (3.0 mm).

Surface clear wear layer 0.5mm

Size: 12 inch x 12 inch.

Colors and Patterns: As selected by Owner from full range of patterns and colors.

2.3 SOLID VINYL FLOOR TILE

Basis of Design: TOLI Corporation, Kareina Asento (150mm plank)

Thickness: 0.120 inch (3.0 mm).

Surface clear wear layer 0.5mm

Fine-beveled

Size: 150 by 900 mm

Colors and Patterns: As selected by Owner

2.4 INSTALLATION MATERIALS

Moisture Mitigation Membrane: Provide one component moisture vapor retarder.

1. Product: Ardex VR 98, Mapei Planiseal MSP or TEC Liquidam EZ
2. Apply to concrete slabs to receive resilient sheet flooring.

Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

3. Products:
 - a. Ardex Feather Finish
 - b. Mapei Planipatch

Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

4. Adhesives shall comply with the following limits for VOC content:
 - a. Vinyl Tile Adhesives: 50 g/L or less.
5. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of

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Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

Special Adhesive for Solid Vinyl Tiles

6. Manufacturer: Tarkett
 - a. Product: 926 Adhesive
7. Manufacturer: Toli International
 - a. Product: CBC 5001 High Performance Adhesive

2.5 FLOOR PROTECTION MATERIALS

Provide floor protection product in areas of completed work.

1. Product: Ram Board
2. Seam Tape: Vapor Cure Tape.

PART 3 - EXECUTION

3.1 EXAMINATION

Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - a. Coordinate removal of existing flooring systems with the selective demolition and asbestos abatement specifications.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - a. If Solvent methods are used to remove asbestos mastics comply with the procedures outlined in the asbestos abatement specifications regarding solvent removal of mastics.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

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- a. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

Vapor Retarder; Apply moisture mitigation membrans/vapor retarder to a properly prepared substrate per manufacturers requirements. Sequence with leveling and patching process as recommended by manufacturer.

Floor Preparation Sequence

5. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges.
6. Flash Patch and Skim Coat the entire floor surface. Lightly sand ridges and bumps using a commercial grade floor sander to produce uniform and smooth substrate.

Do not install floor tiles until they are the same temperature as the space where they are to be installed.

7. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

Comply with manufacturer's written instructions for installing floor tile.

Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

Water Jet cut flooring materials at flooring pattern changes where indicated on the drawings.

Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

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Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

Comply with manufacturer's written instructions for cleaning and protecting floor tile.

Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

Cover floor coverings with specified floor protection material in accordance with manufacturer's instructions until Substantial Completion

END OF SECTION 096519

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates.
- B. Related Requirements:
 - 1. Section 099600 "High-Performance Coatings" for special-use coatings.
 - 2. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.2 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523, a matte flat finish.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 - 3. VOC content.

1.4 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used,

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product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups 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 in Part 3.
 - 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 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture's label with the following information:
 - 1. Product name and type (description).
 - 2. Batch date.
 - 3. Color number.
 - 4. VOC content.
 - 5. Environmental handling requirements.
 - 6. Surface preparation requirements.
 - 7. Application instructions.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company products indicated or comparable product from one of the following:
1. Benjamin Moore & Co.
 2. PPG Architectural Finishes, Inc.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As selected by Architect from manufacturer's full range

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.

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1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
- B. Substrate Conditions:
 1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
 - c. Wood: 15 percent.
 - d. Portland Cement Plaster: 12 percent.
 2. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Aluminum Substrates: Remove loose surface oxidation.
- I. Wood Substrates:

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1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 2. Sand surfaces that will be exposed to view, and dust off.
 3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- J. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Paint entire exposed surface of window frames and sashes.
 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. 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. Paint the following work where exposed to view:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

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1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. Ferrous Metal, Galvanized-Metal, and Aluminum Substrates:
 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Primer, water-based, anti-corrosive for metal[, **MPI #107**]: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, 5.0 to 10.0 mils wet, 2.0 to 4.0 mils dry.
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss, (Gloss Level 5), MPI #163: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
- B. Related Requirements:
 - 1. Section 099600 "High-Performance Coatings" for high-performance and special-use coatings.

1.2 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523, a matte flat finish.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

1.4 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer's label with the following information:

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1. Product name and type (description).
 2. Batch date.
 3. Color number.
 4. VOC content.
 5. Environmental handling requirements.
 6. Surface preparation requirements.
 7. Application instructions.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Lead Paint: Lead paint is likely to be present in buildings and structures to be painted.
1. Use Lead Safe Work Practices in accordance with US Dept.of Housing and Urban Development. All employees working with Lead based paint Materials shall have HUD approved training.
 2. Do not disturb lead paint or items suspected of containing hazardous materials except under procedures specified.
 3. Perform preparation for painting of substrates known to include lead paint in accordance with EPA Renovation, Repair and Painting Rule and additional requirements of authorities having jurisdiction.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company products indicated or comparable product from one of the following:
1. Benjamin Moore & Co.
 2. Devoe
 3. Glidden Professional, Division of PPG Architectural Finishes, Inc.
 4. Pratt & Lambert.
- B. Colors: As selected by Owner. Expected number of colors is indicated in Room finish schedule on Drawing A701.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

D. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."**2.3 SOURCE QUALITY CONTROL****A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:**

1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency may perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.

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1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
- B. Substrate Conditions:
1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
 - c. Gypsum Board: 12 percent.
 - d. Plaster: 12 percent.
 2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
 3. Plaster Substrates: Verify that plaster is fully cured.
 4. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
1. Concrete Floors: Remove oil, dust, grease, dirt, and other foreign materials. Comply with SSPC-SP-13/NACE 6 or ICRI 03732.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. 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. Paint the following work where exposed in equipment rooms:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Plastic conduit.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Plastic conduit.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. Latex System:
 - a. Prime Coat: Primer sealer, latex, interior, MPI #3: S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss, (Gloss Level 4), MPI #43 X-Green: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
- B. CMU Substrates:
 - 1. Latex System:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4 X-Green: S-W PrepRite Block Filler, B25W25, at 100 to 200 sq. ft. per gal.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss, (Gloss Level 4), MPI #43 X-Green: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
- C. Metal Substrates (Aluminum, Steel, Galvanized Steel):
 - 1. Latex System:

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- a. Prime Coat: Primer, rust-inhibitive, water based, MPI #107: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
 - b. Intermediate Coat: Water-based acrylic, interior, matching topcoat.
 - c. Topcoat: Water-based acrylic, semi-gloss, (Gloss Level 5), MPI #147 X-Green: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.
2. Water-Based Dry-Fall System:
- a. Top Coat: Dry-fall latex, eggshell, MPI #131/155: S-W Pro Industrial Waterborne Acrylic DryFall Eg-Shel, B42-2 Series, at 6.0 mils wet, 1.9 mils dry.
- D. Gypsum Board and Plaster Substrates:
1. Latex System:
- a. Prime Coat: Primer, latex, interior, MPI #149 X-Green: S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.5 mils dry.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, eggshell, (Gloss Level 3), MPI #52 X-Green/#145 X-Green: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

END OF SECTION 099123

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and application of high-performance coating systems.
- B. Related Requirements:
 - 1. Section 099113 "Exterior Painting" for special-use coatings and general field painting.
 - 2. Section 099123 "Interior Painting" for special-use coatings and general field painting.

1.2 DEFINITIONS

- A. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.
- B. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.
- C. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.
- D. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523, a high-gloss finish.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.
- B. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each coating system specified in Part 3, with the proposed product highlighted.
 - 3. VOC content.

1.4 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture's label with the following information:
 - 1. Product name and type (description).
 - 2. Batch date.
 - 3. Color number.
 - 4. VOC content.
 - 5. Environmental handling requirements.
 - 6. Surface preparation requirements.

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7. Application instructions.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide The Sherwin-Williams Company; products indicated or comparable product from one of the following:
 1. Benjamin Moore & Co.
 2. PPG Architectural Finishes, Inc.
 3. Tnemec Inc.
- B. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
 1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."
- B. Material Compatibility:
 1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
 3. Provide products of same manufacturer for each coat in a coating system.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.
 1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Primers, Sealers, and Undercoaters: 200 g/L.
 4. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: 250 g/L.
 5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.

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- 6. Pre-Treatment Wash Primers: 420 g/L.
- 7. Floor Coatings: 100 g/L.
- 8. Shellacs, Clear: 730 g/L.
- 9. Shellacs, Pigmented: 550 g/L.

D. Colors: As selected by owner.

2.3 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

- 1. Owner may engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
- 2. Testing agency may perform tests for compliance with product requirements.
- 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
 - 1. Report in writing conditions that may affect application, appearance, or performance of paint.
- B. Substrate Conditions:
 - 1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Concrete Masonry: 12 percent.
 - c. Gypsum Board: 12 percent.
 - 2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
 - 3. Plaster Substrates: Verify that plaster is fully cured.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

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- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, 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 coated surfaces.

3.6 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. CMU Substrates:
 - 1. Epoxy-Modified Latex System:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4: S-W PrepRite Interior/Exterior Block Filler, B25 Series, at 8 mils dry, per coat.
 - b. Intermediate Coat: Epoxy-modified latex, interior, gloss, matching topcoat.
 - c. Topcoat: Epoxy-modified latex, interior, eggshell, (Gloss Level 3), MPI #254/MPI #254X-Green: S-W Pro Industrial Waterbased Catalyzed Epoxy Eggshell, B73-300 Series, at 2.0 to 4.0 mils dry, per coat.
- B. Steel Substrates:
 - 1. Epoxy-Modified Latex System:
 - a. Prime Coat: Primer, rust-inhibitive, water based, MPI #107: S-W Pro-Cryl Universal Primer, B66-310 Series, at 2.0 to 4.0 mils dry, per coat.
 - b. Intermediate Coat: Epoxy-modified latex, interior, gloss matching topcoat.
 - c. Topcoat: Epoxy-modified latex, interior, gloss, (Gloss Level 6), MPI #115/MPI #115X-Green: S-W Pro Industrial Waterbased Catalyzed Epoxy Gloss, B73-300 Series, at 2.0 to 4.0 mils dry, per coat.

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C. Gypsum and Board Plaster Substrates:

1. Epoxy-Modified Latex System:

- a. Prime Coat: Primer sealer, latex, interior, MPI #50: S-W ProMar 200 Zero VOC Interior Latex Primer, B28 Series, at 1.0 mils dry, per coat.
- b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
- c. Topcoat: Epoxy-modified latex, interior, eggshell, (Gloss Level 3), MPI #115/#115X-Green: S-W Pro Industrial Waterbased Catalyzed Epoxy Eggshell, B73-360 Series, at 2.0 to 4.0 mils dry, per coat.

END OF SECTION 099600

ITEM 627.0010 25**SPECIALTIES****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.
- 1.04 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0010 25**SPECIALTIES****1. SPECIFICATION SUMMARY**

- A. Section 101400 SIGNAGE
- B. Section 102113.19 PLASTIC TOILET COMPARTMENTS
- C. Section 102800 TOILET, BATH, AND LAUNDRY ACCESSORIES
- D. Section 104413 FIRE PROTECTION CABINETS

1.02 This item shall include, but not be limited to, the following:

- A. Miscellaneous signage throughout the building's addition
- B. Toilet room accessories such as toilets, lockers, sinks, etc.
- C. Fire protection cabinets

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Panel signs.

1.2 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for signs.
1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
1. Aluminum.
 2. Acrylic sheet.
 3. Polycarbonate sheet.
 4. Fiberglass sheet.
 5. Die-cut vinyl characters and graphic symbols. Include representative samples of available typestyles and graphic symbols.
- D. Sign Schedule: Provide as Submittal.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:

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- a. Deterioration of metal and polymer finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image colors and sign lamination.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
- B. Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating:
 - 1. Impact Resistance: 16 ft-lbf/in. per ASTM D 256, Method A.
 - 2. Tensile Strength: 9000 lbf/sq. in. per ASTM D 638.
 - 3. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. per ASTM D 790.
 - 4. Heat Deflection: 265 deg F at 264 lbf/sq. in. per ASTM D 648.
 - 5. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044.
- C. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing, suitable for exterior applications.

2.2 PANEL SIGNS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **TAKEFORM, INC.: FUSION 51 series** or a comparable product by one of the following:
 - 1. APCO Graphics, Inc.
 - 2. ASI-Modulex, Inc.
 - 3. Mohawk Sign Systems.
- B. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following requirements:
 - 1. High-Pressure Decorative Laminate: 0.035 inch thick.
 - 2. The sign shall incorporate balanced construction with the core sandwiched between laminates to prevent warping. Laminate on the sign face only shall not be acceptable.
 - 3. Tactile lettering shall be precision machined, raised 1/32", matte PETG and subsurface colored for scratch resistance.
 - 4. Signs shall incorporate a metal accent bar. Bars shall be dyed, brushed anodized aluminum .125" thick.
 - 5. The signage system shall be capable of accepting paper or acetate inserts to allow changing and updating as required. Insert modules shall have a .080 thickness non-glare acrylic window and shall be inlaid flush to sign face for a smooth, seamless appearance.
 - 6. The signage system shall, with the exception of directories and overheads, be a maximum 8.5" width to accommodate inserts printed on standard width paper.
 - 7. Manufacturer shall provide a PC template containing layout, font, color, artwork and trim lines to allow owner to produce inserts on a laser or inkjet printer.
 - 8. The signage system shall include modules allowing for inserts, notice holders, occupancy sliders, marker, magnetic, and cork pin boards. All modules shall be flush to sign face for a smooth, seamless appearance.

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9. The signage system shall utilize an acrylic sphere for Grade II Braille inserted directly into a mark and scratch resistant, high pressure laminate sign face. Braille dots are to be pressure fit in high tolerance milled holes. Braille dots shall be half hemispherical domed and protruding a minimum of .025" high.
10. The laminates (front and back) shall be pressure laminated and precision machined together to a 90 degree angle. Edges shall be smooth, void of chips, burrs, sharp edges, marks and polished to a satin luster.
11. The signage system shall incorporate a shim plate. The shim shall raise the sign off the wall allowing for cleaning and/or painting without removal.
12. Mounting: Unframed.
 - a. Wall mounted with two-face tape.
 - b. Manufacturer's standard anchors for substrates encountered.
- C. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit panel sign construction and mounting conditions indicated.
- D. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
 1. Raised-Copy Thickness: Not less than 1/32 inch.
- E. Panel Sign Schedule:
 1. Code required signage to be included in base bid.
 - a. Locations and Quantity – Refer to Floor Plan Drawing A201.
 - b. Signage dimensions, text size and type, and tactile and braille components are to comply with the ADA-ABA Accessibility Guidelines, ICC/ANSI A117.1, and the New York State Building Code.
 - c. Code required signage includes the following types:
 - 1) Sign Type 1: Accessible Toilet Room – Men
 - 2) Sign Type 2: Accessible Toilet Room - Women
 - 3) Sign Type 3: Accessible Toilet Room - Unisex
 - 4) Sign Type 4: Tactile Exit Sign
 - 5) Sign Type 5: Tactile Directional Exit Sign

2.3 TRUSS IDENTIFICATION SIGNAGE

- A. Provide Truss Identification Signage in accordance with Title 19, part 1264, section 505.3 – Appendix H of the New York State Code
 1. Signs identifying the existence of truss construction shall contain the roman alphanumeric designation of the construction type of the building, in accordance with the provisions for the classification of types of construction set forth in section 602 of the Building Code of New York State (see 19 NYCRR Part 1221), and an alphabetic designation for the structural components that are of truss construction, as follows:
 - a. "F" shall mean floor framing, including girders and beams
 - b. "R" shall mean roof framing
 - c. "FR" shall mean floor and roof framing
 2. The construction type designation shall be placed at the twelve o'clock position over the structural component designation, which shall be placed at the six o'clock position.
 3. (f) Signs identifying the existence of truss construction shall be affixed in the locations specified in Table I-1264.

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- B. Sign shall consist of a circle 6 inches in diameter, with a stroke width of ½ inch. The sign background shall be reflective white in color. The circle and contents shall be reflective red in color, conforming to Pantone matching system (PMS) #187.
 - 1. Where a sign is directly applied to a door or sidelight, it may be a permanent non-fading sticker or decal. Signs not directly applied to doors or sidelights shall be of sturdy, non-fading, weather resistant material.
- C. Signs to be provided at all exterior doors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that items, including anchor inserts, are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Interior 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 inches of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
 - 1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
 - 2. Hook-and-Loop Tapes: Mount signs to smooth, nonporous surfaces.
 - 3. Magnetic Tape: Mount signs to smooth, nonporous surfaces.
 - 4. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
 - 5. Shim Plate Mounting: Provide 1/8-inch-thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
 - 6. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
 - 7. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.
- C. Bracket-Mounted Signs: Provide manufacturer's standard brackets, fittings, and hardware for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings

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securely to walls and ceilings with concealed fasteners and anchoring devices to comply with manufacturer's written instructions.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY**A. Section Includes:**

1. Solid-plastic toilet compartments configured as toilet enclosures.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for blocking.
2. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.2 ACTION SUBMITTALS**A. Product Data:** For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of centerlines of toilet fixtures.
3. Show locations of floor drains.
4. Show overhead support or bracing locations.

C. Samples for Initial Selection: For each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.**1.3 INFORMATIONAL SUBMITTALS****A. Product Certificates:** For each type of toilet compartment.**1.4 CLOSEOUT SUBMITTALS****A. Maintenance Data:** For toilet compartments to include in maintenance manuals.**1.5 MAINTENANCE MATERIAL SUBMITTALS****A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents and source.**

1. Door Hinges: Two hinge(s) with associated fasteners.
2. Latch and Keeper: One latch and keeper(s) with associated fasteners.

1.6 PROJECT CONDITIONS**A. Field Measurements:** Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 75 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Global Partitions; ASI Group.
 - 2. Scranton Products.
 - 3. General Partitions Mfg. Corp.
- B. Toilet-Enclosure Style: Floor anchored /Overhead braced.
- C. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than **1 inch** thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material. Panels are waterproof non-absorbent and have self-lubricating surface that resist markings from pens, pencil and other writing instruments.
 - 1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
 - 2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
 - 3. Color and Finish: One color and Finish in each room as selected by Architect from manufacturer's full range. Finish is based upon Tough Texture (TT).
- D. Pilaster Shoes: Manufacturer's standard design; stainless steel.
- E. Brackets (Fittings):
 - 1. Wall: Full-Height (Continuous) Type at Urinal Screen: Manufacturer's standard design; stainless.
 - 2. Wall: Stirrup (3/Connection) at All other Partitions: Manufacturer's standard design; extruded aluminum.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
 - 1. Hinges: Manufacturer's minimum **0.062-inch**-thick stainless-steel continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door. Mount with through-bolts.
 - 2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply

with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.

3. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with anti-grip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Aluminum Extrusions: **ASTM B221**
- B. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- C. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Floor-Anchored Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Door Size and Swings: Unless otherwise indicated, provide **24-inch**-wide, in-swinging doors for standard toilet compartments and **36-inch**-wide, out-swinging doors with a minimum **32-inch**-wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 1. Maximum Clearances:
 - a. Pilasters and Panels: **1/2 inch**.

- b. Panels and Walls: 1 inch.
 - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 - B. Floor-Anchored /Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- 3.3 ADJUSTING**
- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.19

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
- B. Owner-Furnished Material: Refer to drawings

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.7 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. A & J Washroom Accessories, Inc.
 2. American Specialties, Inc.
 3. Bobrick Washroom Equipment, Inc.
 4. Bradley Corporation.
- B. Grab Bar:
 1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc. – B-5806 series
 2. Mounting: Flanges with concealed fasteners.
 3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin).
 4. Outside Diameter: 1-1/4 inches.
 5. Configuration and Length: As indicated on Drawings.
- C. Mirror Unit:
 1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.
 - a. Model B-290 Series
 2. Frame: Stainless-steel angle.
 - a. Corners: Manufacturer's standard, welded.
 3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

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- b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
- D. Toilet Tissue (Roll) Dispenser:
 - 1. Basis-of-Design Product: Bobrick B-2740.
 - 2. Description: Double-roll dispenser.
 - 3. Mounting: Surface mounted.
 - 4. Capacity: Designed for **up to 6"** diameter tissue rolls.
 - 5. Material and Finish: Cast aluminum (satin finish).
- E. Paper Towel Roll Dispenser:
 - 1. Basis-of-Design Product: Bobrick No. B-253
 - 2. Mounting: Surface mounted.
 - 3. Minimum Capacity: 6" diameter standard paper towel roll.
 - 4. Material and Finish: Cast aluminum (satin finish).
- F. Liquid-Soap Dispenser:
 - 1. Basis-of-Design Product: Bobrick No. B-26617
 - 2. Description: Designed for dispensing soap in liquid or lotion form.
 - 3. Mounting: Vertically oriented, surface mounted.
 - 4. Capacity: 1000 ml
 - 5. Materials: Stainless steel, Type 304.
 - a. Finish: Smooth, No. 4, satin finish.
 - 6. Lockset: Bobrick system key.
 - 7. Refill Indicator: Window type.
- G. Sanitary-Napkin Disposal Unit:
 - 1. Basis-of-Design Product: Bobrick No. B-270.
 - 2. Mounting: Surface mounted,
 - 3. Receptacle: Removable.
 - 4. Material and Finish: Stainless steel, No. 4 finish (satin).
- H. Surface-Mounted QuietDry Series Hand Dryer:
 - 1. Basis of Design: Bobrick TerraDry Model B-7188 115V.
 - a. Cover: One-piece, aluminum die-casting with chrome finish.
 - b. Power: 115V AC, 8.5 amp, 1000 watts, 50/60 Hz, single phase, cULus listed.

2.3 CUSTODIAL ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Specialties, Inc.
 - 2. Bobrick Washroom Equipment, Inc.
 - 3. Bradley Corporation.
- B. Mop and Broom Holder:
 - 1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
 - 2. Length: 36 inches.
 - 3. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
 - 4. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.

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- b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.4 CLOTHES HOOK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Specialties, Inc.
 - 2. Bobrick Washroom Equipment, Inc. B 211 (Basis of Design)
 - 3. Bradley Corporation.
- B. Locations: As indicated on the drawings.
 - 1. Description: Heavy duty clothes hook
 - 2. Material and Finish: Stainless steel, No. 4 finish (satin).

2.5 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY**A. Section Includes:**

1. Fire-protection cabinets
2. Portable fire extinguishers.

1.2 ACTION SUBMITTALS

- A. **Product Data:** For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. **Shop Drawings:** For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. **Product Schedule:** For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.3 CLOSEOUT SUBMITTALS

- A. **Maintenance Data:** For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. **Fire-Rated Fire-Protection Cabinets:** Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

- A. **Cabinet Type:** Suitable for fire extinguisher.
 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. Larsens Manufacturing Company. **Architectural Series, Vertical Duo Door Model 2409-6R – (Basis of Design)**
 - b. Potter Roemer LLC.

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- c. JL Industries, Inc.; a division of the Activar Construction Products Group.

- B. Cabinet Construction: Nonrated, 1-hour fire rated, or 2-hour fire rated as required by wall construction.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.

- C. Cabinet Material: Cold-rolled steel sheet.

- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

- E. Cabinet Trim Material: Steel sheet.

- F. Door Material: Steel sheet.

- G. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting lever handle with cam-action latch.
 - 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.

- H. Accessories:
 - 1. Identification for fire extinguisher cabinet: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Silk-screened.
 - 3) Lettering Color: Red.
 - 4) Orientation: Horizontal.
 - 2. Identification: Fire extinguisher location sign: Wall mounted 3-way view sign.
 - a. Identify fire extinguisher in fire-protection cabinet with the ARROW pointing down and words "FIRE EXTINGUISHER."
 - 1) Location: Wall mounted above fire extinguisher cabinet
 - 2) Plastic tent sign, 18" long; Basis-of-Design: JL Industries 23S.
 - 3) Colors: White background, Red arrow, White lettering.
 - 4) Orientation: Vertical.

I. Cabinet Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors and color densities.

2.3 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers, of type, size, and capacity indicated, for each cabinet.
- B. Multipurpose Dry-Chemical Type: UL-rated 4-A : 80-B : C, 10-lb (4.5-kg) nominal capacity, in enameled-steel container.
- C. Provide one additional extinguisher of the same type, with a bracket for wall mounting, in the Mechanical Room.

2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
 3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

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- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

ITEM 627.0012 25**FURNISHINGS****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.
- 1.02 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0012 25

FURNISHINGS

1. SPECIFICATION SUMMARY

1.01 This Item includes the following specifications:

- A. Section 123530 RESIDENTIAL CASEWORK
- B. Section 123661 SOLID SURFACING COUNTERTOPS

1.02 This item shall include, but not be limited to, the following:

- A. Casework and countertops for the building's addition

SECTION 123530 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes kitchen cabinets.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For residential casework. Include plans, elevations, details, and attachments to other work.
- C. Samples: For casework and hardware finishes.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For casework.

PART 2 - PRODUCTS

2.1 CABINETS

- A. Basis of Design: Masco Cabinetry - KRAFTMAID.
- B. Quality Standard: Provide cabinets that comply with KCMA A161.1.
 - 1. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location of each unit and showing compliance with KCMA A161.1.
- C. Door and Drawer Face Style: Reveal overlay.
 - 1. Door and Drawer Fronts: Solid-wood stiles and rails, 3/4 inch (19 mm) thick, with 1/4-inch- (6.4-mm-) thick, veneer-faced plywood center panels.
- D. Cabinet Style: Face frame.
 - 1. Face Frames: 3/4-by-1-5/8-inch (19-by-41-mm) solid wood.
- E. Exposed Cabinet End Finish: Wood veneer.

2.2 CABINET MATERIALS

- A. Hardwood Lumber: Kiln dried to 7 percent moisture content.
- B. Softwood Lumber: Kiln dried to 10 percent moisture content.
- C. Hardwood Plywood: HPVA HP-1.
- D. Particleboard: ANSI A208.1, Grade M-2.
- E. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
- F. MDF: Medium-density fiberboard, ANSI A208.2, Grade MD.
- G. Hardboard: ANSI A135.4, Class 1 tempered.

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H. Exposed Materials:

1. Exposed Wood Species: Oak.
 - a. Select materials for compatible color and grain. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color, grain, figure, or natural character markings.
 - b. Staining and Finish: As selected by Architect from manufacturer's full range.
 2. Solid Wood: Clear hardwood lumber of species indicated, free of defects.
 3. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A faces and Grade C backs of same species as faces.
 - a. Edge band exposed edges with veneer edging of same species as face veneer.
 4. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS and edgebanded.
 - a. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.
 - b. Plastic-Laminate Edgebanding: Of same grade, pattern, color, and texture of plastic laminate as for faces.
 - c. PVC Edgebanding: Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, and 1 mm thick elsewhere.
- 1) Color: As selected by Architect from cabinet manufacturer's full range.

I. Semiexposed Materials: Unless otherwise indicated, provide the following:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces.
2. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces. Face veneers of same species as exposed surfaces.
3. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS.

J. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; MDF; or hardboard.

2.3 CABINET HARDWARE

- A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.
- B. Pulls: Back-mounted decorative pulls.
- C. Hinges: Concealed European-style, self-closing hinges.
- D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or Type B05091.
- E. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.
 1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.

2. Drawers: Provide one bumper on back side of drawer front at each corner.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install casework with no variations in adjoining surfaces; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework.
- B. Install casework without distortion so doors and drawers fit the openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.
- C. Install casework level and plumb to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).
- D. Fasten casework to adjacent units and to backing.
 - 1. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c.
 - a. Fasteners: No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through the metal backing or metal framing behind the wall finish.
- E. Adjust hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- F. Clean casework on exposed and semiexposed surfaces. Touch up as required to restore damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 123530

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY**A. Section Includes:**

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material window sills
5. Solid surface material sinks.

1.2 ACTION SUBMITTALS

- A. Product Data:** For countertop materials.
- B. Shop Drawings:** For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
1. Show locations and details of joints.
 2. Show direction of directional pattern, if any.
- C. Samples for Initial Selection:** For each type of material exposed to view.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data:** For fabricator.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data:** For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications:** Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications:** Fabricator of countertops.

1.6 FIELD CONDITIONS

- A. Field Measurements:** Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.7 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.**

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
1. Basis-of-Design Product: Subject to compliance with requirements, provide E. I. du Pont de Nemours and Company; Corian.
 2. Type: Provide Standard type unless Special Purpose type is indicated.
 3. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
 4. Colors and Patterns: As selected by Architect.
- B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
1. Grade: Premium.
- B. Configuration:
1. Front: Straight, slightly eased at top.
 2. Backsplash: Straight, slightly eased at corner.
 3. End Splash: Matching backsplash.
- C. Countertops: 1/2-inch- (12.7-mm-) thick, solid surface material with front edge built up with same material.
- D. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material.
- E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
1. Fabricate with loose backsplashes for field assembly.
 2. Install integral sink bowls in countertops in the shop.
- F. Joints: Fabricate countertops without joints.
- G. Cutouts and Holes:
1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, rounded to 3/8-inch (10-mm) radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch (5 mm) into fixture opening.
 2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.
- B. Secure countertops to cabinets with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- D. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- E. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- F. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

ITEM 627.0022 25**PLUMBING****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the Specification Sections listed below
- 1.04 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0022 25**PLUMBING****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

A.	Section 220500	COMMON WORK RESULTS FOR PLUMBING
B.	Section 220513	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
C.	Section 220519	METERS AND GAUGES FOR PLUMBING PIPING
D.	Section 220523	GENERAL DUTY VALVES FOR PLUMBING PIPING
E.	Section 220529	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
F.	Section 220553	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
G.	Section 220700	PLUMBING INSULATION
H.	Section 221116	DOMESTIC WATER PIPING
I.	Section 221119	DOMESTIC WATER PIPING SPECIALTIES
J.	Section 221123	DOMESTIC WATER PUMPS
K.	Section 221124	FACILITY NATURAL GAS PIPING
L.	Section 221316	SANITARY WASTE AND VENT PIPING
M.	Section 221319	SANITARY WASTE PIPING SPECIALTIES
N.	Section 221423	STORM DRAINAGE PIPING SPECIALTIES
O.	Section 223400	FUEL-FIRED DOMESTIC WATER HEATERS
P.	Section 224000	PLUMBING FIXTURES
Q.	Section 224700	WATER COOLERS

1.02 This item shall include, but not be limited to, the following:

A.	Plumbing necessary for the building's addition, including break room and locker room areas
B.	Storm water piping

SECTION 22 0500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Plumbing demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings and crawlspace.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. The following are industry abbreviations for rubber materials:
 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Provide product literature and warranty information for all products listed in this section and for the final O & M Manuals:
 1. Transition fittings.

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2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

- B. Welding certificates for certified welders.
- C. Maintenance data for the final O & M Manuals.

1.5 COORDINATION DRAWINGS

- A. Before construction work commences, the Contractor for this trade shall coordinate with all other trades and shall submit coordination drawings in the form of electronic drawing files or reproducible transparencies, drawn at not less than 1/4 inch scale. Such drawings will be required throughout all work areas, for all Contracts. The Plumbing Contractor shall be accountable for determining plumbing and equipment conflicts with the ductwork, heating piping, structure, foundations, beams and wall construction with respect to the work of this trade. The Plumbing Contractor shall provide written descriptions and schematic drawings for any conflicts discovered and determined during demolition and investigation of the building conditions for review by the Engineer. Schematics shall include suggested piping routings if different than the construction plans and proposed cost reductions or additions. The coordination drawings shall show resolutions determined jointly by the Contractors of trade conflicts in congested areas. Boiler, Electrical and Mechanical Equipment Rooms shall be drawn early in coordination drawing process simultaneous with all other congested areas. Provide for and prepare Coordination Drawings As Follows:

1. The Plumbing Contractor shall prepare the base plan coordination drawings showing all ductwork, all pertinent heating piping, and equipment. These drawings may be sepias of the required ductwork Shop Drawings. The drawings shall be coordinated with lighting fixtures, air diffusers, other ceiling mounted items, ceiling heights, structural work, maintenance clearances, electric code clearance, reflected ceiling plans, and other contract requirements. Reposition proposed locations of work after coordination drawing review by the Owner's Representative. Provide adjustments to exact size, location, and offsets of ducts, pipes, conduit, etc., to achieve reasonable appearance objectives. Provide these adjustments as part of contract. Minor revisions need not be redrawn.
2. The Plumbing Contractor shall provide reproducible and/or prints and submit the base plan to all Contractors. Electronic drawing files may be furnished to the contractors which have the CAD capabilities required for their use.
3. HVAC Contractor shall draft location of piping and equipment on the base plan, indicating areas of conflict and suggested resolutions.
4. The Electrical Contractor shall draft location of lighting fixtures, cable trays, and feeders over 1-1/2 in. on the base plan, indicating areas of conflict and suggested resolution.
5. The General Construction Contractor shall indicate areas of architectural/structural conflicts or obstacles and coordinate to suit the overall construction schedule.
6. The Construction Manager shall expedite all drawing work and coordinate to suit the overall construction schedule. In the case of unresolved interferences, he shall notify the Owner's Representative. The Owner's Representative will then direct the various contractors as to how to revise their drawings as required eliminating installation interferences.
7. If a given Contract proceeds prior to resolving conflicts, then if necessary, that Contract shall change its work at no extra cost in order to permit others to proceed with a

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coordinated installation. Coordination approval will be given by areas after special site meetings involving all Contracts.

- B. The purpose of the coordination drawing process is to identify and resolve potential conflicts between Contracts, and between Contracts and existing building construction, before they occur in construction. Coordination drawings are intended for the respective Contractor's use during construction and shall not replace any Shop Drawings, or record drawings required elsewhere in these contract documents.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- D. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020), the Fuel Gas Code of New York State (2020) and all New York State Amendments.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes 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.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Provide for and coordinate requirements for access panel locations and doors for plumbing items including water hammer arrestors, electric transformers, valves and balance valve assemblies requiring access that are concealed behind finished surfaces with the General Contractor. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full Face Type: For flat face, Class 125, cast iron and cast bronze flanges.
 - b. Narrow Face Type: For raised face, Class 250, cast iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead free alloys. Include water-flushable flux according to ASTM B 813.
- E. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.

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- b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Adaptors and Condensate Drain Connectors: One piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent cement joint end. For connection HVAC unit manufacturer's plastic P-trap, flexible, clear or fire resistant condensate connection hose and stainless steel band clamp couplings.
- 1. Manufacturers:
 - a. Thompson Plastics, Inc.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Diversitech.
 - d. Fernco.
 - e. Rectorseal.
 - f. Watco.
- C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC four part union. Include brass end, solvent cement joint end, rubber O-ring, and union nut.
- 1. Manufacturers:
 - a. NIBCO INC.
 - b. NIBCO, Inc.; Chemtrol Div.
 - c. Dresser Industries, Inc.; DMD Div.
 - d. Ford.
- D. Flexible Transition Couplings for Underground Drainage Piping: ASTM C 1173 with elastomeric sleeve ends same size as piping to be joined and corrosion resistant stainless steel metal band clamps with full shield on each end.
- 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.

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- C. Dielectric Unions: Factory fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory fabricated, companion flange assembly, for 150 or 300 psig minimum working pressure as required to suit system pressures.
1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric Couplings: Galvanized steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
 - c. Watts.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300 psig minimum working pressure at 225 deg F.
1. Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.

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- c. Metraflex Co.
- d. Pipeline Seal and Insulator, Inc.

- 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- 3. Pressure Plates: Stainless steel. Include two for each sealing element.
- 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized Steel Sheet: 0.0239 inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Stack Sleeve Fittings: Manufactured, cast iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One Piece, Deep Pattern Type: Deep drawn, box shaped brass with polished chrome plated finish.
- C. Two Piece, Cast Brass Type: With set screw.
 - 1. Finish: Polished chrome plated and rough brass.
- D. Split Casting, Cast Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome plated and rough brass.
- E. Two Piece, Stamped Steel Type: With set screw or spring clips and chrome plated finish.
- F. Split Plate, Stamped Steel Type: With concealed hinge, set screw or spring clips, and chrome plated finish.
- G. Two Piece, Floor Plate Type: Cast iron floor plate.
- H. Split Casting, Floor Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic cement grout.

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1. Characteristics: Post hardening, volume adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000 psi, 28 day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap remaining piping with same or compatible piping material if not reused.
 2. Piping to Be Abandoned in Place: Drain piping, cut at ends to isolate from existing piping systems to remain and cap or plug piping ends with the same or compatible piping material.
 3. Equipment to Be Removed: Disconnect and cap plumbing piping and remove equipment.
 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make plumbing equipment operational.
 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove plumbing equipment and deliver to Owner. Verify with Owner items to be salvaged prior to commencing with work.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, due to the work of this contract, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Provide piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Provide piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Provide piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal.

- F. Provide piping to permit valve servicing.
- G. Provide piping at indicated slopes.
- H. Provide piping free of sags and bends.
- I. Provide fittings for changes in direction and branch connections.
- J. Provide piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Provide escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern type.
 - b. Chrome Plated Piping: Two piece, cast brass type with polished chrome plated finish.
 - c. Insulated Piping: Two piece, stamped steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Two piece, cast brass type with polished chrome plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass type with polished chrome plated finish.
 - f. Bare Piping in Unfinished Service Spaces: Two piece, cast brass type with rough brass finish.
 - g. Bare Piping in Equipment Rooms: Two piece, cast brass type.
 - h. Bare Piping at Floor Penetrations in Equipment Rooms: Two piece, floor plate type.
 - 2. Existing Piping: Provide the following:
 - a. Chrome Plated Piping: Split casting, cast brass type with chrome plated finish.
 - b. Insulated Piping: Split plate, stamped steel type with concealed hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass type with chrome plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass type with chrome plated finish.
 - e. Bare Piping in Unfinished Service Spaces: Split casting, cast brass type with rough brass finish.
 - f. Bare Piping in Equipment Rooms: Split casting, cast brass type.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split casting, floor plate type.
- M. Sleeves are not required for core drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.

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- O. Provide sleeves for pipes passing through fire rated concrete and masonry walls and concrete floor and roof slabs.
- P. Provide sleeves for pipes passing through fire rated concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Provide sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Provide sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Provide the following sleeve materials:
 - a. Steel Sheet Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Q. Underground, Exterior Wall Pipe Penetrations: Provide cast iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1 inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- S. Verify final plumbing equipment and piping locations against other trade work prior to roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

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- U. Provide for the final connection of all condensate drain piping at air conditioning units provided by Division 23 to the condensate drain piping provided by Division 22. Condensate piping shall be insulated. Refer to 220700. Provide a flexible connector hose, clear and recommended for use for condensate drainage and stainless steel band clamp couplings to connect air conditioning unit to piping.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PLUMBING PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Provide unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of plumbing equipment.
 - 2. Provide flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.5 PLUMBING EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Provide equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Provide equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

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- C. Provide plumbing equipment to facilitate service, access, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Provide for equipment clearances in compliance with manufacturer's written installation instructions. This Contractor shall coordinate the locations of plumbing equipment with the other trades and report any discrepancies, conflicting equipment locations, building conditions or structural issues to the Engineer. This Contractor shall provide sketches of recommended re-routing of piping or relocation of equipment to the Engineer describing proposed locations.
- D. Provide plumbing piping and equipment with clearances and paths installed at required slopes for drainage. Slopes may be adjusted to accommodate existing conditions. Notify Engineer of any proposed changes in writing.

3.6 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- C. Paint all new, interior and exterior natural gas piping and natural gas vent piping exposed to view throughout the building with one (1) coat rust inhibitor, one (1) coat primer and two (2) coats finish metal alkyd enamel paint. Paint all piping in mechanical room spaces, bus maintenance garage and bus garage and high school roof top areas. Wire brush all piping prior to paint applications.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base in accordance with equipment manufacturer's written instructions.
 - 1. Provide and construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported water heaters, pumps or expansion tanks.
 - 2. Provide and install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 inch centers around the full perimeter of the base.
 - 3. Provide epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, written recommended instructions, and directions furnished with items to be embedded.
 - 5. Provide anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Provide anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000 psi, 28 day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast in Place Concrete".

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

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- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.
- D. Metal supports or unistrut assemblies shall be used at all thermostatic mixing valve and recirculation pump mounting locations on walls.
- E. Provided supports with factory finish or prime and paint supports.

3.9 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 22 0500

SECTION 22 0513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general requirements for single phase and polyphase, general purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
- B. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020) and all New York State Amendments

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. 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.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed 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 Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. 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.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 22 0513

SECTION 22 0519 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Liquid-in-glass thermometers.
 - 2. Thermowells.
 - 3. Dial type pressure gauges.
 - 4. Gauge attachments.

1.3 SUBMITTALS

- A. Product data and warranty information for each type of product indicated in this section and for the final O & M Manuals.
- B. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020) and all New York State Amendments.
- C. Product warranties for all products in this section.
- D. Operation and maintenance data for the final O & M Manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal Case, Industrial Style, Liquid-in-Glass Thermometers:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Winters Instruments - U.S.A. Model TSW-132 or comparable product by one of the following:
 - a. Flo Fab Inc.
 - b. Miljoco Corporation.
 - c. Palmer Wahl Instrumentation Group.
 - d. Tel-Tru Manufacturing Company.
 - e. Trerice, H. O. Co.
 - f. Weiss Instruments, Inc.
 - g. Winters Instruments - U.S.
 - 2. Standard: ASME B40.200.
 - 3. Case: Cast aluminum; 8 inch nominal size unless otherwise indicated.
 - 4. Case Form: Straight unless otherwise indicated.
 - 5. Tube: Glass with magnifying lens and red organic liquid.

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6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Window: #N – 16 Glass.
8. Stem: Aluminum and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure tight, socket type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, or 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required matching thermometer bulb or stem.
9. Insertion Length: Length required matching thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAUGES

A. Direct Mounted, Metal Case, Dial Type Pressure Gauges:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Winters Instruments - U.S.A. Series P1S238 for domestic water services or comparable product by one of the following:
 - a. AMETEK, Inc.; U.S. Gauge.
 - b. Ashcroft Inc.
 - c. Ernst Flow Industries.
 - d. Flo Fab Inc.
 - e. Marsh Bellofram.
 - f. Miljoco Corporation.
 - g. Noshok.
 - h. Palmer Wahl Instrumentation Group.
 - i. Terice, H. O. Co.
 - j. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - k. Weiss Instruments, Inc.
 - l. WIKA Instrument Corporation - USA.

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2. Standard: ASME B40.100.
3. Case: Liquid filled Sealed type(s); cast aluminum or drawn steel; 3-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark colored metal.
9. Window: Glass.
10. Ring: Polished Brass.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAUGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and porous-metal-type surge dampening device. Include extension for use on insulated piping. Winters Instruments - U.S.A. Model SAS or approved equal.
- B. Valves: Brass or stainless steel needle, with NPS 1/4, ASME B1.20.1 pipe threads. Winters Instruments - U.S. model SNV or approved equal.

2.5 TEST PLUGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Winters Instruments - U.S. or comparable product by one of the following:
 1. Flow Design, Inc.
 2. Miljoco Corporation.
 3. National Meter, Inc.
 4. Peterson Equipment Co., Inc.
 5. Sisco Manufacturing Company, Inc.
 6. Trerice, H. O. Co.
 7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 8. Weiss Instruments, Inc.
- B. Description: Test station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Provide thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Provide thermowells with extension on insulated piping.
- D. Fill thermowells with heat transfer medium.
- E. Provide direct mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Provide remote mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Provide minimum tubing length.
- G. Provide direct mounted pressure gauges in piping tees with pressure gauge located on pipe at the most readable position.
- H. Provide valve and snubber in piping for each pressure gauge for fluids.
- I. Provide test plugs in piping tees.
- J. Provide thermometers in the following locations:
 - 1. Inlets and outlets of each domestic thermostatic hot water mixing valve.
 - 2. Domestic water heater inlets and outlets.

3.2 CONNECTIONS

- A. Provide thermometers and gauges adjacent to plumbing equipment to allow service and maintenance.

3.3 ADJUSTING

- A. Adjust faces of meters and gauges to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

- A. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F and minus 20 to plus 50 deg C.
- B. Scale Range for Domestic Hot-Water Piping: 40 to 280 deg F and 5 to 135 deg C.

3.6 PRESSURE-GAUGE SCHEDULE

- A. Pressure gauges at discharge of each re-circulation pump and mixing valve in the building shall be the following:

1. Liquid filled sealed and direct mounted, metal case.

3.7 PRESSURE-GAUGE SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION – 22 0519

SECTION 22 0523 – GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bronze ball valves
2. Bronze swing check valves

B. Related Sections:

1. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.2 SUBMITTALS

- A. Product data and warranty information for each type of product indicated in this section and for final O & M Manuals.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: ANSI/NSF 61, NSF 62 Annex G and NSF 372 for valve materials for potable-water service. Lead content shall not exceed 0.25 percent maximum by weighted average.
- C. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020) and all New York State Amendments.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 1. Handlever: For quarter-turn valves NPS 3 and smaller.
- E. Valves in Insulated Piping: With 2 inch stem extensions and the following features:

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1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Solder Joint: With sockets according to ASME B16.18.
2. Threaded: With threads according to ASME B1.20.1.

2.2 BRONZE BALL VALVES

A. Two Piece, Full Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide Watts Regulator Co. Series LFFBV-3C and LFFBVS-3C or products by one of the following:
 - a. Milwaukee Valve Company.
 - b. NIBCO INC.
 - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 125 psig.
 - c. CWP Rating: 400 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Lead free ASTM B 62; NSF 372, Bronze.
 - f. Ends: Threaded.
 - g. Seats: TFE.
 - h. Stem: extended stem for insulation, 316 SS.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide Watts Regulator Co.; a division of Watts Water Technologies, Inc. Series LF777, LFCV or LFCVS products or one of the following:
 - a. Hammond Valve.
 - b. NIBCO INC.
 - c. Apollo.
2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: Lead free ASTM B 62, bronze.

- e. Ends: Threaded.
- f. Disc: Bronze.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Provide valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Provide valves in horizontal piping with stem at or above center of pipe.
- D. Provide valves in position to allow full stem movement. Provide valve handle extensions for insulation to clear installed piping insulation.
- E. Provide swing check valves for proper direction of flow and in horizontal position with hinge pin level.

3.2 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball valves.
 - 2. Sump Pump Discharge Check Valves: Bronze swing type.
 - a. NPS 2 inches and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2-1/2 inches and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
 - c. NPS 2-1/2 inches and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 inches and Smaller: Threaded ends except where solder joint valve end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 inches to NPS 4 inches: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 inches and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 inches and Smaller: Threaded ends.

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5. For Steel Piping, NPS 2-1/2 inches to NPS 4 inches: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 inches and Smaller:

1. Bronze Valves: May be provided with solder joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, bronze with bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 inches and NPS 3 inches:

1. Bronze Valves, NPS 2-1/2 inches to NPS 3 inches: May be provided with threaded ends instead of flanged ends.
2. Ball Valves: Two piece, full port, bronze with bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.

END OF SECTION 22 0523

SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.
7. Roof top pipe supports for gas piping.

1.2 SUBMITTALS

- A. Product data and warranty information for each type of product indicated in this section and for the final O & M Manuals.
- B. Welding certificates for certified welders.
- C. Product warranties for all products in this section.
- D. Operation and maintenance data for the final O & M Manuals.

1.3 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020), the Fuel Gas Code of New York State (2020) and all New York State Amendments.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper coated steel, factory fabricated components.
2. Hanger Rods: Continuous thread rod, nuts, and washer made of copper coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop or field fabricated pipe support assembly made from structural carbon steel shapes with MSS SP-58 carbon steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL HANGER SHIELD INSERTS

- A. Insulation Insert Material for Piping: ASTM C 552, Type II cellular glass with 100 psig minimum compressive strength and vapor barrier.
- B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

- A. Powder Actuated Fasteners: Threaded steel stud, for use in hardened Portland cement concrete with pull out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical Expansion Anchors: Insert wedge type, zinc coated steel anchors or stainless steel, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop or field fabricated equipment support made from structural carbon steel shapes.

2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory mixed and packaged, dry, hydraulic cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000 psi, 28 day compressive strength.

2.8 ROOF TOP PIPE SUPPORTS FOR GAS PIPING

- A. Roof Top Pipe Supports: One piece polycarbonate resin roof deck base, pipe support and adjustable roller housing. Roller housing of polycarbonate resin and 1/2 inch minimum stainless steel rods adjustable in height including carbon black color with UV protection.
- B. Performance: To support gas piping up to 8-1/2 inches in diameter for a roof top application.
- C. Basis of Design Manufacturer: Miro Industries Model 6-RAH-7 or Engineer approved equal product.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Provide hangers, supports, clamps, and attachments as required supporting the piping properly from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, carbon steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Provide in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 1. Provide powder actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Provide operators that are licensed by powder-actuated tool manufacturer. Provide fasteners according to powder actuated tool manufacturer's operating manual.
 2. Provide mechanical expansion anchors in concrete after concrete is placed and completely cured. Provide fasteners according to manufacturer's written instructions.
- E. Pipe Positioning System Installation: Provide support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.
- F. Provide hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded structural steel shapes.

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- H. Provide hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Provide lateral bracing with pipe hangers and supports to prevent swaying.
- J. Provide building attachments within concrete slabs or attach to structural steel. Provide additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 inches and larger and at changes in direction of piping. Provide concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Provide hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Provide hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Provide thermal hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Provide MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal hanger shield inserts may be used. Provide steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Provide MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal hanger shield inserts may be used. Provide steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - 5. Thermal Hanger Shields: Provide with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Provide 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous thread hanger and support rods to 1 inch or less.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Provide same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Provide hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Provide nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Provide carbon steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Provide copper plated pipe hangers and copper attachments for copper piping and tubing.
- G. Provide padded hangers for piping that is subject to scratching.
- H. Provide thermal hanger shield inserts for insulated piping and tubing.
- I. Horizontal Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, provide the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 inches to NPS 8 inches.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 inches to NPS 6 inches, requiring up to 4 inches of insulation.
 - 3. Carbon or Alloy Steel, Double Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 inches to NPS 8 inches, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 inches to NPS 8 inches.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 inches to NPS 8 inches.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 inches to NPS 8 inches, with steel pipe base stanchion support and cast iron floor flange or carbon steel plate.
 - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 inches to NPS 8 inches, with steel pipe base stanchion support and cast iron floor flange or carbon steel plate, and with U-bolt to retain pipe.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 inches to NPS 8 inches, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 inches to NPS 8 inches if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- J. Vertical Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, provide the following types:

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1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 inches to NPS 8 inches.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 inches to NPS 8 inches if longer ends are required for riser clamps.
- K. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, provide the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, provide the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top of Beam C-Clamps (MSS Type 19): For use under roof installations with bar joist construction; to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Provide one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 8. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: Provide for supporting insulated pipe.
- N. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- O. Provide powder actuated fasteners or mechanical expansion anchors instead of building attachments where required in concrete construction.
- P. Provide pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

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- Q. Provide roof top pipe supports spaced every 10 feet under gas piping and each change in direction on the roof of the bus maintenance facility and the high school. Each support shall be provided with a ½ inch thick by 2 foot square rubber isolation pad between the roofing material and base of support.

END OF SECTION 22 0529

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 SUBMITTAL

- A. Product data and warranty information for each type of product indicated in this section and for the final O & M Manuals.
- B. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020), the Fuel Gas Code of New York State (2020) and all New York State Amendments.
- C. Product warranties for all products in this section.
- D. Operation and maintenance data for the final O & M Manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Valve Tags:

1. Material and Thickness: Brass, 0.032 inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Letter Size: 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.
3. Fasteners: Stainless steel rivets or cable.
4. Basis of Design Manufacturer: Seton Style 300 or approved equal.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

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6. Minimum Letter Size: 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.
 7. Fasteners: Stainless-steel rivets.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, typewritten on 8-1/2 by 11 inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 8 by 6 inches.
- F. Minimum Letter Size: 1/2 inch for name of units if viewing distance is less than 24 inches, 1 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.
- G. Fasteners: Stainless steel rivets or cable.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service, and showing flow direction.
- B. Pre-tensioned Pipe Labels: Pre-coiled, semi rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

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- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1 inch high.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Provide for or permanently fasten labels on each major item of mechanical equipment with anchors or plastic coated stainless steel chains.
- B. Locate equipment labels where accessible and visible.

3.3 VALVE TAGS

- A. Provide valve tags on all domestic water piping valves installed as a part of this project work. Provide a typewritten valve tag chart to be located in the boiler room 4'-0" above the finished floor. Fasten chart to wall. Valve chart shall include valve number, size, location in building and service.

3.4 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Painting of piping is specified in Division 09 Section "Interior Painting."
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed 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 inaccessible 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 30 feet along each run. Reduce intervals to 15 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 - 1. Domestic Cold Water Piping:

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- a. Background Color: Green
 - b. Letter Color: White (CW)
- 2. Domestic Hot Water Piping:
 - a. Background Color: Yellow
 - b. Letter Color: Black (HW)
- 3. Domestic Hot Water Re-Circulation Piping:
 - a. Background Color: Yellow
 - b. Letter Color: Black (HWR)
- 4. Natural Gas Piping:
 - a. Background Color: Yellow
 - b. Letter Color: Black (NG)
- 5. Indirect Waste and Condensate Piping:
 - a. Background Color: Green
 - b. Letter Color: White (IW)
- 6. Storm Water Piping:
 - a. Background Color: Green
 - b. Letter Color: White (ST)
- 7. Sanitary Vent Piping:
 - a. Background Color: Green
 - b. Letter Color: White (V)
- 8. Sanitary Waste Piping:
 - a. Background Color: Green
 - b. Letter Color: White (SAN)

END OF SECTION 22 0553

SECTION 22 0700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Mineral fiber – (glass fiber).
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Factory applied jackets.
7. Field applied fabric reinforcing mesh.
8. Field applied jackets.
9. Tapes.
10. Securements.
11. Corner angles.

1.2 SUBMITTALS

- A. Product data and warranty information for each type of product indicated in this section and for the final O & M Manuals.
- B. Product warranties for all products in this section.
- C. Operation and maintenance data for the final O & M Manuals.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke developed index of 150 or less.
- B. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020), the Energy Conservation Construction Code of New York State (2020) and all New York State Amendments.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000 Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 degree F. Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Adhesive Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.

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2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Speedline Vinyl Adhesive.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 25 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
2. Water Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43 mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-10.
 - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
 - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
 - d. Marathon Industries, Inc.; 550.
 - e. Mon-Eco Industries, Inc.; 55-50.
 - f. Vimasco Corporation; WC-1/WC-5.

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2. Water Vapor Permeance: ASTM F 1249, 3 perms at 0.0625 inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.4 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, use sealants that have a VOC content of 25 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire and water resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, 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).

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory applied jackets on various applications. When factory applied jackets are indicated, comply with the following:

1. ASJ: White, kraft paper, fiberglass reinforced scrim with aluminum foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure sensitive, acrylic based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.6 TAPES

A. ASJ Tape: White vapor retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

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2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbs. /inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbs. / inch in width.

2.7 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.

2.8 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Provide insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

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- B. Provide insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Provide accessories compatible with insulation materials and suitable for the service. Provide accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Provide insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Provide multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Provide insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Provide insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Provide insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Provide insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Provide insulation with factory applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

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- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above ambient services, do not install insulation to the following:
 - 1. Vibration control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Identification or labeling.

3.3 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire Rated Wall and Partition Penetrations: Provide insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 Section "Firestopping" and fire-resistive joint sealers.
- C. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Provide insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Provide insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt

each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- C. Insulate instrument connections for thermometers, pressure gauges, pressure temperature taps, test connections and sensors on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.5 MINERAL FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Provide preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

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4. Provide jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Provide preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Provide preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3.6 FIELD QUALITY CONTROL

A. Provide for tests and inspections of insulation.

B. Tests and Inspections:

1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location of straight pipe, one location of threaded fittings, one location of welded fittings, two locations of threaded strainers, one location of welded strainers, one location of threaded valves, and one location of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Underground piping.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3. Identification and labeling.

3.8 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water: Insulation shall be the following:
 1. Mineral Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick wall for 3 inch diameter piping and less. Provide 1 inch thick insulation on 4 inch diameter and larger cold water piping.
- B. Domestic Hot Water: Insulation shall be Mineral Fiber, Preformed Pipe Insulation, Type I: Wall Thickness as follows:
 1. 1/2 inches diameter pipe = 1 inches thick
 2. 3/4 inches diameter pipe = 1 inches
 3. 1 inches diameter pipe = 1 inches
 4. 1-1/4 inches diameter pipe = 1 inches
 5. 1-1/2 inches diameter pipe = 1-1/2 inches
 6. 2 inches diameter pipe = 2 inches
 7. 2-1/2 inches diameter pipe = 2 inches
- C. Domestic recirculated hot water: Insulation shall be the following:
 1. Mineral-Fiber, Preformed pipe insulation, Type I: 1 inch thick.
- D. Storm water piping and overflow: Insulation shall be the following:
 1. Mineral-Fiber, Preformed pipe insulation, Type I: 1 inch thick.
- E. Roof drain and overflow roof drain bodies: Insulation shall be the following:
 1. Mineral-Fiber, Preformed pipe insulation, Type I: 1 inch thick.
- F. Exposed sanitary drains, domestic water, domestic hot water, and stop valves for plumbing fixtures for people with disabilities: Insulation shall be the following:
 1. Flexible PVC fitting covers for ADA compliant fixtures: 1/2 inch thick.
- G. Condensate or indirect waste piping supporting mechanical equipment and water heaters: Insulation shall be the following:
 1. Mineral-Fiber, Preformed pipe insulation, Type I: 1/2 inch thick.

3.9 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Provide jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Pipe Fittings Only; Concealed and Exposed:

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1. PVC: 30 mils thick.

D. Exposed pipe insulation in occupied rooms:

1. Encase all exposed pipe insulation in occupied rooms with PVC pipe covers.
 - a. The thickness shall be 30 mils and from floor level to 8 feet above finished floor. Piping over 8 feet above finished floor shall not be required to have PVC jacketing.
 - b. Bond all PVC seams in occupied rooms with polyco VP adhesive, or equal. Bond adhesive shall conform to ASTM D-2654.

END OF SECTION 22 0700

SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020) and all New York State Amendments.
- C. The domestic water piping and components shall comply with ANSI/NSF 61, NSF 62 Annex G and NSF 372 for drinking water components. The lead content of drinking water piping and components shall not exceed 0.25 percent by weighted average. Plastic piping components shall be marked with "NSF-pw."

1.2 SUMMARY

- A. Section Includes:
 - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.3 SUBMITTALS

- A. Product data and warranty information for each type of product indicated in this section and for the final O & M Manuals.
- B. System pressure test, purging and disinfecting activities report for the final O & M Manuals.
- C. Product warranties for all products in this section.
- D. Operation and maintenance data for the final O & M Manuals.

1.4 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Architect no fewer than three days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K.
- C. Wrought Copper, Solder Joint Fittings: ASME B16.22, wrought copper solder fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder joint ends.
- E. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast copper alloy, hexagonal stock body.
 - 3. Ball and socket, metal to metal seating surfaces.
 - 4. Solder joint or threaded ends.
- F. Copper, Pressure –Seal Fitting:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Viega Plumbing & Heating Systems or comparable product by one of the following:
 - a. Cello Products
 - b. Gruvlok
 - c. Grinnell
 - d. Anvil
 - 2. NPS 2” and smaller: Wrought-copper fitting with EPDM O-ring seal in each end
 - 3. NPS 2-1/2” to NPS 4”: Bronze fitting with stainless steel grip ring and EPDM O-ring in each end.
 - 4. Low lead content less than 0.23 percent in compliance with NSF-62 Annex-G & NSF 372.

2.3 PIPING JOINING MATERIALS

- A. Pipe Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full face or ring type unless otherwise indicated.
- B. Metal, Pipe Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Plastic, Pipe Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve Type Transition Coupling: AWWA C219.

1. Basis-of-Design Product: Subject to compliance with requirements, provide a Ford Meter Box Company, Inc. (The) or comparable product by one of the following:
 - a. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Piping Specialties Products.
 - c. JCM Industries.
 - d. Romac Industries, Inc.
 - e. Smith-Blair, Inc.; a Sensus company.
 - f. Viking Johnson.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts; a division of Watts Water Technologies, Inc. Series 3000 or comparable product by one of the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. Jomar International.
 - e. Matco-Norca.
 - f. McDonald, A. Y. Mfg. Co.
 - g. Wilkins; a Zurn Company.
2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

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2. Basis-of-Design Product: Subject to compliance with requirements, provide Watts; a division of Watts Water Technologies, Inc. Series 3000 or comparable product by one of the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Central Plastics Company.
 - c. Matco-Norca.
 - d. Wilkins; a Zurn company.
3. Standard: ASSE 1079.
4. Factory fabricated, bolted, companion flange assembly.
5. Pressure Rating: 125 psig minimum at 180 deg F.
6. End Connections: Solder joint copper alloy and threaded ferrous; threaded solder joint copper alloy and threaded ferrous.

D. Dielectric Nipples:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts; a division of Watts Water Technologies, Inc. Series 3000 or comparable product by one of the following:
 - a. Elster Perfection Corporation.
 - b. Grinnell Mechanical Products; Tyco Fire Products LP.
 - c. Matco-Norca.
 - d. Precision Plumbing Products, Inc.
 - e. Victaulic Company.
2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Provide piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Provide copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Provide building shutoff valve, hose-end drain valves, strainer, pressure gauge, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gauges in Division 22 Section "Meters and Gauges for Plumbing Piping" and with requirements for drain valves and strainers in Division 22 Section "Domestic Water Piping Specialties."
- D. Provide full port ball shutoff valve immediately upstream of each dielectric fitting.

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- E. Provide water pressure reducing valves downstream from full port ball shutoff valves for mechanical make-up water services. Comply with requirements for pressure-reducing valves in Division 22 Section "Domestic Water Piping Specialties."
- F. Provide domestic water piping level with 0.25 percent slope downward toward drain.
- G. Provide piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- H. Provide piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- I. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- J. Provide piping and valves to permit valve servicing, access and removal.
- K. Provide nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- L. Provide piping free of sags and bends.
- M. Provide fittings for changes in direction and branch connections.
- N. Provide unions in copper tubing at final connection to each piece of plumbing equipment and specialty.
- O. Provide pressure gauges on the water supplies of mixing valves. Comply with requirements for pressure gauges in Division 22 Section "Meters and Gauges for Plumbing Piping."
- P. Provide thermometers on inlet and outlet piping from each water heater. Provide thermometers on each domestic hot water storage tank. Provide thermometers on all inlet and outlet piping of domestic hot water thermostatic mixing valves. Comply with requirements for thermometers in Division 22 Section "Meters and Gauges for Plumbing Piping."
- Q. Provide sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."
- R. Provide sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing."
- S. Provide escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.

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- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

- A. Provide transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve type coupling.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Provide dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Provide dielectric couplings.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Provide dielectric flanges.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42 clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

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4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at the midpoint of each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Provide hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 3/4 and Smaller: 60 inches with 3/8 inch rod.
 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8 inch rod.
 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8 inch rod.
 4. NPS 2-1/2: 108 inches with 1/2 inch rod.
 5. NPS 3 to NPS 4: 10 feet with 1/2 inch rod.
- E. Provide supports for vertical copper tubing every 10 feet and at the midpoint of each floor.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment allow space for service and maintenance.
- C. Connect domestic water piping to water-service piping with full port ball valve; extend and connect to the following:
 1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code. Comply with requirements for connection sizes in Division 22 plumbing fixture Sections.
 2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than plumbing fixture or equipment connections. Provide full port ball shutoff valve and union for each connection. Provide flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Division 22 Section "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

- A. Provide for the following tests and inspections:
 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

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- 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Provide written inspection reports and have them signed by authorities having jurisdiction. Provide copies of test reports for the final O & M Manuals.
2. Piping Tests:
- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Provide written test and inspection reports for domestic water systems to be included in the final O & M Manuals.

3.9 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Adjust balancing valves in hot water circulation return piping to provide adequate flow.
 - a. Manually adjust balancing valves in hot water circulation return piping to provide hot water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 6. Remove and clean strainer screens at the completion of all project work. Close drain valves and replace drain plugs.

7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow water to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow water to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Provide and submit written reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction for the final O & M Manuals.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under building slab, domestic water piping, NPS 2 and smaller, shall be the following:
 1. Soft copper tube, ASTM B 88, Type K; wrought copper, copper pressure seal joint fittings; and pressure sealed joints. No joints shall be below grade.
- E. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder joint fittings; and no-lead soldered joints.
- F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:

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1. Hard copper tube, ASTM B 88, Type L; wrought copper, solder joint fittings; and no lead soldered joints.

END OF SECTION 22 1116

SECTION 22 1119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Balancing valves.
3. Temperature-actuated, hot water mixing valves.
4. Strainers.
5. Hose bibbs.
6. Wall hydrants.
7. Drain valves.
8. Water-hammer arresters.

B. Related Requirements:

1. Division 22 Section "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
2. Division 22 Section "Domestic Water Piping" for water meters.
3. Division 22 Section "Emergency Plumbing Fixtures" for water tempering equipment.

1.2 SUBMITTALS

- A. Product data and warranty information for each type of product indicated in this section and for the final O & M Manuals.
- B. Operation and maintenance data for the final O & M Manuals.
- C. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020) and all New York State Amendments.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with ANSI/NSF 61, NSF 62 Annex G and NSF 372. Domestic water system piping components shall not exceed 0.25 percent lead content by weighted average.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

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1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
3. Body: Lead free bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Chrome plated.
6. Basis of Design Manufacturer: Watts Regulator Company Series LF288-A or approved equal.

B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Lead free bronze, non-removable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Chrome or nickel plated.
5. Basis of Design Manufacturer: Watts Regulator Company Series N9C or Series LF800 or approved equal.

2.4 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide a Bell & Gossett "Circuit Setter" or comparable product by one of the following:
 - a. Armstrong.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO Inc.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Lead free bronze or copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.5 THERMOSTATIC MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Basis-of-Design Product: Subject to compliance with requirements; Leonard Valve Company, Inc. Model TM-420B-LF-DT or comparable product by one of the following:
 - a. Armstrong International, Inc.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Symmons Industries, Inc.

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2. Standard: ASSE 1017 listed.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Type: Exposed mounted, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components. Lead free.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot and cold water supplies, and adjustable, temperature control handle.
8. Tempered-Water Setting: 110 degrees F.
9. Tempered-Water Design Flow Rate: 0.5 gpm to 26 gpm.
10. Selected Valve Flow Rate at 10 psig Pressure Drop: 18 gpm.
11. Minimum Flow rate: 0.5 gallons per minute.
12. Valve Finish: Rough bronze.
13. Piping Finish: Copper.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Lead free bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.020 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
 - c. Strainers NPS 5 and Larger: 0.10 inch.
6. Drain: Factory-installed, hose-end drain valve with cap.
7. Basis of Design Manufacturer: Apollo 59-LF Series or approved equal.

2.7 HOSE BIBBS

A. Hose Bibbs (HB):

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Lead free bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder joint inlet.
5. Outlet Connection: Garden hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field installation, nonremovable, drainable, hose connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle.
12. Operation for Service Areas: Loose operating key.

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13. Operation for Finished Rooms: Loose operating key.
14. Include operating key with each operating key hose bibb.
15. Include integral wall flange with each chrome or nickel plated hose bibb.
16. Basis of Design Manufacturer: Woodford Manufacturing Model 84 in finished spaces and Chicago Brass Model 998 in mechanical rooms or approved equal.

2.8 NON-FREEZE WALL HYDRANT (Exterior – Cold Water) – NFWH

- A. Non-freeze key operated exposed type wall hydrant with chrome plated face, lead free components, integral vacuum breaker, 3/4" hose connection, 3/4" female x 1" male pipe connection, all bronze head, seat casting and internal working parts, bronze wall casing, and two (2) sets of loose removable keys. Complies with ASSE 1019-2004, UPC / IAMPO Listed. Maximum operating pressure of 125 psi. Length to match wall thickness.
- B. Basis of Design Manufacturer: Watts Drainage HY-420 or approved equal.

2.9 DRAIN VALVES

- A. Ball Valve Type, Hose-End Drain Valves:
 1. Standard: MSS SP-110 for standard port, two piece ball valves.
 2. Pressure Rating: 400 psig minimum CWP.
 3. Size: NPS 3/4.
 4. Body: Lead free bronze or copper alloy.
 5. Ball: Chrome plated brass.
 6. Seats and Seals: Replaceable.
 7. Handle: Vinyl covered steel.
 8. Inlet: Threaded or solder joint.
 9. Outlet: Threaded, short nipple with garden hose thread complying with ASME B1.20.7 and cap with brass chain.
 10. Basis of Design Manufacturer: Apollo Series 70LF Series - or approved equal.

2.10 WATER-HAMMER ARRESTERS

- A. Water-Hammer Arresters (WHA)
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts Drainage Products Series 15 or comparable product by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Precision Plumbing Products, Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
 2. Standard: ASSE 1010 or PDI-WH 201.
 3. Type: Copper tube with piston. Lead free components.
 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Provide and locate backflow preventers in same room as connected equipment or system. Provide backflow prevention devices in compliance with the written instructions of the New York State Health Department Cross Connection Control Manual and in compliance with the Erie County Department of Health, and Erie County Water Authorities written requirements.
 - 2. Provide a drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
 - 4. Locate backflow prevention devices 30 to 60 inches above floor, 8 inches away from wall and provide 12 inches clearance above and 30 inches of clearance in front of devices for access and servicing.
- B. Provide balancing valves on domestic hot water re-circulation piping in locations where they can easily be adjusted. Provide for and adjust the flow of all building balance valves while there is no hot water use in the building.
- C. Provide temperature actuated, water mixing valves with check stops and full port ball shutoff valves on inlets and with full port ball shutoff valve on outlet. Provide thermometers on inlet and outlet piping. Locate mixing valves in accessible location as close to water heater as possible. Do not reduce inlet and outlet piping sizes. Provide full size piping up to and as close as possible to inlets and outlets of valves. Locate valve between 30 and 48 inches above finish floor. Locate valve as close to water heaters as possible and provide unistrut support system to support valve from wall.
- D. Provide bronze Y-pattern strainers for water on supply side of each control valve, water pressure reducing valve, solenoid valve and pump.
- E. Provide water hammer arresters in supply water piping at all banks of flush valves according to PDI-WH 201. Valves shall be located in accessible location near the top of plumbing chase, near removable ACT ceiling or be provided with a keyed lockable access door.
- G. Provide wall hydrants in exterior walls. Hydrant shall be flush with flange tight to wall and watertight. Confirm thickness of wall assembly prior to ordering wall hydrants. Piping shall be located in non-freeze areas. Insulate all supply piping to wall hydrants and provide full port ball valve shut-off on supply to hydrant for isolation. Provide for and coordinate with the Architectural construction plans and wall sections for locations and elevations. If not indicated, provide wall hydrants 30 inches above finish floor or grade.
- H. Provide hose end drain valves at all low points in cold, hot and hot water recirculation piping and at the base of risers between floor levels.

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- I. Provide and locate thermostatic mixing valve and recirculation pump for domestic water heater in Bus Garage on unistrut bar support system anchored to wall near water heater.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements for ground equipment in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each pressure vacuum breaker and reduced pressure principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Provide written test and inspection reports for backflow prevention devices on New York State Health Department forms and for the final O & M Manuals.

END OF SECTION 22 1119

SECTION 22 1123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Domestic Hot Water Recirculation Pumps.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated in this section.
- B. Operation and maintenance data for each pump including electrical data and pump curves.
- C. Warranty: Product warranties for the final O & M Manuals.
- D. Power and control wiring diagrams.
- E. System profile analysis including pump curves and system curve.
- F. Pump data sheets indicating materials of construction.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.
- C. The pump control panel shall be listed by and bear the label of Underwriter's Laboratory, Inc. (UL/cUL). The controller shall be specifically designed for pressure booster applications.
- D. The manufacturer's production facility shall be certified by an approved independent testing and certification organization as being compliant with the requirements of NSF/ANSI 61 and NSF-61 Annex G. The manufacturing facility shall be subjected to periodic inspections and audits.
- E. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020) and all New York State Amendments.

PART 2 - PRODUCTS

2.1 DOMESTIC HOT WATER RECIRCULATION PUMPS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide a Grundfos UP-26-99-F Series or comparable product by one of the following:
 - 1. Armstrong Pumps Inc.
 - 2. Bell & Gossett, Xylem.
 - 3. Goulds.

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- B. Description: Factory assembled and factory tested, in-line, close coupled, canned motor, sealless, overhung impeller centrifugal pumps.
- C. Pump Construction:
1. Pump and Motor Assembly: Hermetically sealed replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
 2. Casing: Bronze, with threaded or companion flange connections.
 3. Impeller: Plastic or composite.
 4. Motor: Single speed, unless otherwise indicated.
- D. Capacities and Characteristics: (Refer to Schedule on Drawings for Pump Sizes)
1. Capacity: Gpm as indicated on plan schedule.
 2. Total Dynamic Head: Head as indicated on plan schedule.
 3. Minimum Working Pressure: 125 psig.
 4. Maximum Continuous Operating Temperature: 220 degrees F.
 5. Pump Speed: 1750 rpm.
 6. Pump Control: Aqua-stat.
 7. Motor Horsepower: H.P. as indicated on plan schedule.
 8. Electrical Characteristics:
 - a. Volts: 120
 - b. Phases: Single.
 - c. Hertz: 60.
- E. Pump shall be of the in-line wet rotor design. Oil lubricated pumps and shaft coupled pumps shall not be accepted. The pump shall be a standard product of a single pump manufacturer. The pump, motor, and variable speed drive shall be an integral product designed and built by the same manufacturer. The enclosure shall be marked "Enclosure Type 2. The pump shall be certified and listed by a Nationally Recognized Test Laboratory (NRTL) for U.S. and Canada to comply with: CAN/CSA, UL 60730-1A and UL 778.
- F. The pump shall be labeled on the nameplate as having an Energy Efficiency Index (EEI) of no greater than 0.20. Maximum Pressure: 175 PSIG B. Minimum Media Temperature: 14 degrees °F. Maximum Media Temperature 230 degrees F. Maximum Continuous Media Temperature: 203 degrees F. Maximum Sound Pressure Level: 43dB. Voltage: 1x115V +/-10%. Maximum Energy Efficiency Index: 0.20.
- G. Materials of Construction: Pump housing: Stainless Steel: 304 Stainless, Impellers: Composite PES 30% GF, Rotor Can: PPS reinforced with Carbon Fiber (Fortran MT9141L PPS-GF40). Rotor Cladding: 316 Stainless Steel, Stator Housing: Aluminum, Shaft: 316L Stainless Steel, Thrust Bearing: Axial: Carbon Graphite, Radial: ceramic Alumina Hilox 961, O-Rings: EPDM, Bearing Plate: 304 Stainless Steel, Neck Ring: 304 Stainless Steel, Control Box: Polycarbonate.
- H. Motor: Motor shall be 4-pole permanent-magnet (PM motor) and tested with the pump as one unit by the same manufacturer. Conventional asynchronous squirrel-cage motors shall not be acceptable. Each motor shall be of the integrated Variable Speed Drive design consisting of a motor and a Variable Frequency Drive (VFD) built and tested as one unit by the same

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manufacturer. The stator housing shall be made of pressure die cast aluminum. The motor shall be cooled by the pumped fluid. The power electronics shall be cooled to the ambient air. The motor shall be self-ventilating. Minimum insulation class for the motor shall be Class F. The integrated VFD control shall utilize an energy optimization algorithm to minimize energy consumption by reducing the factory-set set-point and adjust to system characteristics. This shall be accomplished by without the need of any external sensors or input.

2.2 CONTROLS

- A. Aqua-stats: Electric; adjustable for control of hot-water circulation pump.
 - 1. Type: strap-on temperature sensor, for installation on piping.
 - 2. Range: 65 degrees F. to 200 degrees F.
 - 3. Differential: 5 degrees F. to 30 degrees F. adjusted
 - 4. Operation of Pump: On or off.
 - 5. Transformer: Provide if required.
 - 6. Power Requirement: 120 V, ac.
 - 7. Settings for 110 degrees F. hot water: Start pump at 105 degrees F. and stop pump at 110 degrees F. adjusted.

PART 3 - PRODUCTS

3.1 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Provide domestic hot water recirculation pumps with shaft horizontal unless otherwise indicated.
- C. Provide continuous-thread hanger rods or uni-strut framing of size required to support pump weight.
 - 1. Support pumps from mechanical room wall. Provide manufacturer's required mounting brackets or unistrut supports. Locate pump and thermostatic mixing valve as close to water heater as possible.
 - 2. Comply with requirements for hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Provide aqua-stats in hot-water return piping.
- E. Provide dielectric unions and full port ball valves on inlet and outlet connections of pumps.
- F. Provide a bronze strainer on inlet side of pumps.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Provide piping adjacent to pumps to allow service and maintenance.

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- C. Connect domestic water piping to pumps. Provide suction and discharge piping equal to or greater than size of pump nozzles.
 - 1. Provide full port ball shutoff valve and strainer on suction side of each pump, and check, full port ball shutoff, and balancing valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping" and comply with requirements for strainers specified in Division 22 Section "Domestic Water Piping Specialties."
 - 2. Provide a pressure gauge and snubber at suction of each pump and a pressure gauge and a snubber at the discharge of each pump. Provide at integral pressure-gauge tapings where provided or install pressure-gauge connectors in suction and discharge piping around pumps. Comply with requirements for pressure gauges and snubbers specified in Division 22 Section "Meters and Gauges for Plumbing Piping."
- D. Comply with Division 26 Sections for electrical connections, and wiring methods.
- E. Connect aquastats to pumps that they control.

3.3 ADJUSTING

- A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- D. Field adjust all re-circulation pumps and domestic hot water mixing valves. The total capacity of the adjusted balance valves in gallons per minute shall match the recirculation pump discharge flow in gallons per minute at rated feet of head. Valves shall only be adjusted while flowing hot water in the building at all fixtures including showers, lavatories and sinks.

3.4 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Provide piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps with type "L" copper piping. Provide suction and discharge piping equal to or greater than size of pump suction and discharge nozzles.
 - 1. Provide dielectric unions on connections to pumps in suction and discharge piping of the pump.
 - 2. Provide full port ball shutoff valve and strainer on the suction side of each pump, and check, shutoff, and throttling valves on the discharge side of each pump. Provide valves same size as connected piping. Comply with requirements for valves specified in Division 22 Section "General Duty Valves for Plumbing Piping" and comply with requirements for strainers specified in Division 22 Section "Domestic Water Piping Specialties."

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3. Provide a pressure gauge at the suction of each pump and a pressure gauge at the discharge of each pump. Provide at integral pressure-gauge taps where provided or install pressure-gauge connectors in suction and discharge piping around pumps. Comply with requirements for pressure gauges and snubbers specified in Division 22 Section "Meters and Gauges for Plumbing Piping."
- D. Comply with Division 26 Sections for power electrical connections, and wiring methods.

END OF SECTION 22 1123

SECTION 22 1124 - FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe, unheated spaces immediately below roof, spaces above ceilings, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 - 2. Service Regulators: 100 psig minimum unless otherwise indicated.
 - 3. Minimum Operating Pressure of Service Meter: 1/2 psig or less.
- B. Natural Gas System Pressure within Buildings: 12 inches of water column or less.
- C. Provide natural gas piping systems in compliance with local utility (i.e., National Fuel Gas) written requirements.
- D. Comply with the written installation requirements of National Fuel Gas.
- E. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020), the Fuel Gas Code of New York State (2020) and all New York State Amendments.

1.5 SUBMITTALS

- A. Product Data: For each type of the following:

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1. Piping specialties.
 2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 3. Pressure regulators. Indicate pressure ratings and capacities.
 4. Dielectric fittings.
 5. Pipe materials.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
1. Shop Drawing Scale: 1/4 inch per foot.
- C. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- D. Welding certificates.
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For motorized gas valves and pressure regulators to include in emergency, operation, and maintenance manuals.
- 1.6 QUALITY ASSURANCE
- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
 - C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
 - B. Deliver pipes and tubes 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.
 - C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility locating service for area where Project is located.
- B. Interruption of Existing Natural Gas Service: Do not interrupt natural gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural gas supply according to requirements indicated:
 - 1. Notify Architect no fewer than three days in advance of proposed interruption of natural gas service.
 - 2. Do not proceed with interruption of natural-gas service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade A.
 - 1. Malleable Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Mechanical Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dresser Piping Specialties; Division of Dresser, Inc.
 - 2) Smith-Blair, Inc.
 - b. Stainless steel flanges and tube with epoxy finish.
 - c. Buna-nitrile seals.
 - d. Stainless steel bolts, washers, and nuts.

2.2 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

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1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 6. Service Mark: Valves 1-1/4 inches to NPS 2 inches shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 inches and Larger: Comply with ASME B16.38.
1. CWP Rating: 125 psig.
 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide Milliken Valve Company or products by one of the following:
 - a. Flowserve.
 - b. Homestead Valve; a division of Olson Technologies, Inc.
 - c. McDonald, A. Y. Mfg. Co.
 - d. Milliken Valve Company.
 - e. Mueller Co.; Gas Products Div.
 - f. R&M Energy Systems, a Unit of Robbins & Myers, Inc.
 2. Body: Cast iron, complying with ASTM A 126, Class B.
 3. Plug: Bronze or nickel-plated cast iron.
 4. Seat: Coated with thermoplastic.
 5. Stem Seal: Compatible with natural gas.
 6. Ends: Threaded or flanged as indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 7. Operator: Square head or lug type with tamperproof feature where indicated.
 8. Pressure Class: 125 psig.
 9. Listing: Valves NPS 1 inch and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural gas service with "WOG" indicated on valve body.

2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Hart Industries International, Inc.
 - c. Jomar International Ltd.
 - d. Matco-Norca, Inc.
 - e. McDonald, A. Y. Mfg. Co.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - g. Wilkins; a Zurn company.
2. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig minimum at 180 deg F.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping, equipment and connections against the work of other trades before commencing with equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to the International Fuel Gas Code of New York State (2020) to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with the Fuel Gas Code of New York State (2020) requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with the Fuel Gas Code of New York State (2020) for installation and purging of natural gas piping.
- B. Provide fittings for changes in direction and branch connections.
- C. Comply with National Fuel Gas requirements for the installation and purging of natural gas piping.
- D. Provide fittings for changes in direction and branch connections.

3.4 INDOOR PIPING INSTALLATION

- A. Comply with Fuel Gas Code of New York State (2020) for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Provide piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Provide piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Provide and locate valves for easy access and future removal.
- H. Provide natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Provide piping free of sags and bends.
- J. Provide fittings for changes in direction and branch connections.
- K. Verify final gas equipment locations for roughing-in of piping.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to building outdoors and terminate with weatherproof vent cap. Locate vents away from operable windows and air intakes. Extend vents up exterior building walls and or through roofs. Provide flashing at vents and water tight through roofs with downturned elbows. Provide steel pipe supports on vertical walls every 8 feet for vents attached to walls, extend above roof line 3 feet and terminate with a vent cap. Paint all exposed piping, supports and anchors.

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- O. Pipe installations exposed to view shall be labeled "Gas".
- P. Concealed Location Installations:
 - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - 2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
 - 3. Prohibited Locations:
 - a. Do not install natural gas piping in or through circulating air ducts, building air supply or return air plenums, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
- Q. Provide eccentric reducer fittings to make reductions in pipe sizes. Provide and install fittings with level side down.
- R. Connect branch piping from top or side of horizontal piping.
- S. Provide unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of gas fired equipment. Unions are not required at flanged connections.
- T. Do not use natural-gas piping as grounding electrode.
- U. Provide strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- V. Provide and install sleeves for piping penetrations of walls, ceilings, and floors.
- W. Provide sleeve seals for piping penetrations of concrete walls and slabs.
- X. Provide escutcheons for piping penetrations of walls, ceilings, and floors.
- Y. Provide for painting of all exposed interior and exterior exposed natural gas piping, valves, supports and fittings. Provide (1) one coat rust inhibitor, (1) - one coat primer and (2) - two coats metal alkyd enamel finish paint. Final color selection by Architect. Wire brush all piping prior to paint applications.

3.5 VALVE INSTALLATION

- A. Provide a manual lubricated plug type gas shutoff valve, dirt leg and union for each water heater.

3.6 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.

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- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Provide hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 - 2. NPS 3/4 and 1 Maximum span, 96 inches; minimum rod size, 3/8 inch
 - 3. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 4. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 5. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
 - 6. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.
 - 7. Provide vertical gas piping supports with a maximum span not exceeding 96 inches.
- C. Provide vertical supports to building walls, steel or structure for gas piping and vents every 8 feet minimum.

3.8 CONNECTIONS

- A. Provide natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- B. Provide piping adjacent to appliances to allow service and maintenance of appliances.
- C. Connect piping to appliances using manual lubricated plug gas shutoff valves and unions. Provide valve within 18 inches of each, boiler, water heater and gas-fired appliance. Provide a union between valve and, boiler, water heaters, appliances or equipment.

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- D. Sediment Traps: Provide tee fitting with capped nipple in bottom to form drip, as close as practical to gas inlet of each gas fired, water heater, boiler or appliance.

3.9 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for piping and valve identification. Provide labels on all gas piping. Piping shall have manufactured pipe labels every 15 feet and at each change in direction.

3.10 PAINTING

- A. Comply with requirements in Division 09 painting Sections for painting exposed interior and exterior natural gas piping.
- B. Paint all exposed interior and exterior metal gas piping and gas vent piping, valves, service regulators, service meters and meter bars, supports and piping specialties, except components, with factory-applied paint or protective coating.

- 1. Alkyd System: MPI EXT 5.1D.

- a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel gloss.
 - d. Color: Yellow for interior gas piping in the mechanical rooms and final color to match building exterior brick finish for exterior vent piping at meter set and vents through roof for boilers or water heater regulators.

- C. Paint all exposed, interior metal gas piping and gas vent piping, valves, service regulators and piping specialties, except components, with factory-applied paint or protective coating.

- 1. Alkyd System: MPI INT 5.1E.

- a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior alkyd matching topcoat.
 - c. Topcoat: Interior alkyd gloss.
 - d. Color: Yellow for gas piping and blue for vent piping.

- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

- A. Provide written pressure tests and inspections reports for the final O & M Manuals.

- B. Tests and Inspections:

- 1. Test, inspect, and purge natural gas according to the International Fuel Gas Code of New York State (2015) and authorities having jurisdiction. Pressure test piping at 15 psig for 1 hour.

- C. Natural gas piping will be considered defective if it does not pass tests and inspections.
- D. Provide test and inspection reports for gas pressure test for the final O & M Manuals.

3.12 OUTDOOR PIPING SCHEDULE

- A. Aboveground natural gas piping shall be one of the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, branch piping NPS 2 and smaller shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping NPS 2-1/2 and larger shall be the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints.

3.14 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be the following:
 - 1. Cast-iron, lubricated plug valve.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:
 - 1. Cast-iron, lubricated plug valve.
- C. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be the following:
 - 1. Cast-iron, lubricated plug valve.
- D. Valves in branch piping for any single gas fired appliance shall be the following:
 - 1. Cast-iron, lubricated plug valve.

END OF SECTION 22 1124

SECTION 22 1316 – STORM, SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide sanitary waste and vent piping in compliance with Chapter's 7, 8, 9 and 10 the International Plumbing Code of New York State (2020).
- B. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020) and all New York State Amendments.

1.3 SUBMITTALS

- A. Product data and warranty information for each type of product indicated in this section and for the final O & M Manuals.
- B. Piping system pressure test reports for the final O & M Manuals.
- C. Product warranties for all products in this section.
- D. Operation and maintenance data for the final O & M Manuals.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service weight class, asphalt coated.
- B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service weight class, asphalt coated ASTM A 888 or CISPI 310 couplings.
- B. Heavy Duty, Shielded Hubless Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. Dallas Specialty & Mfg. Co.
 - d. MIFAB, Inc.
 - e. Mission Rubber Company; a division of MCP Industries, Inc.
 - f. Stant.
 - g. Tyler Pipe.
 - 2. Standards: ASTM C 1277 and ASTM C 1540.
 - 3. Description: Stainless-steel shielded with double 301 stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
 - 4. Basis of Design Manufacturer: Mifab Model MI-HUB-TR or approved equal.

2.4 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder joint end.
 - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- D. Solder: ASTM B 32, lead-free with ASTM B 813, water flushable flux.

2.5 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 3. Shielded Transition Couplings:

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- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cascade Waterworks Mfg. Co.
 - 2) Mission Rubber Company; a division of MCP Industries, Inc.
 - 3) Fernco.
 - 4) Mifab.
- 4. Standard: ASTM C 1460. ASTM C 1460-2012, I.A.P.M.O. (U.P.C.), CSA B602-2010 and ASTM C 1540.
 - a. Description: Elastomeric or rubber sleeve with full length, corrosion resistant outer shield and corrosion resistant metal tension band and tightening mechanism on each end.
 - b. Basis of Design Manufacturer: Fernco Model SR or approved equal.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and other design considerations. Provide piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Provide piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Provide piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Provide piping at indicated slopes.
- F. Provide piping free of sags and bends.
- G. Provide fittings for changes in direction and branch connections.
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Provide long-turn; double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Provide proper size of standard increasers

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and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- I. Lay buried building drainage piping beginning at low point of each system. Provide true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Provide required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- J. Provide soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. Provide cast iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- L. Provide aboveground copper tubing according to CDA's "Copper Tube Handbook."
- M. Plumbing Specialties:
 - 1. Provide cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity flow piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 2. Install drains in sanitary drainage gravity flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
- N. Do not enclose, cover, or put piping concealed behind walls or above ceilings into operation until it is inspected and approved by authorities having jurisdiction.
- O. Provide sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing Piping."
- P. Provide sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing."
- Q. Provide escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

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- B. Join hubless, cast iron soil piping with shielded couplings according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
 - C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water flushable, lead-free flux and ASTM B 32, lead-free alloy solder.
- 3.4 SPECIALTY PIPE FITTING INSTALLATION
- A. Transition Couplings:
 - 1. Provide transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Shielded transition couplings.
- 3.5 HANGER AND SUPPORT INSTALLATION
- A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Provide carbon steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Provide carbon steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS Type 8 or Type 42 clamps.
 - 4. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 6. Base of Vertical Piping: MSS Type 52, spring hangers.
 - B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
 - C. Support vertical piping and tubing at base and at each floor.
 - D. Rod diameter may be reduced one size for double-rod hangers, with 3/8 inch minimum rods.
 - E. Provide hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 inch and NPS 2 inch: 60 inches with 3/8 inch rod.
 - 2. NPS 3 inch: 60 inches with 1/2-inch rod.
 - 3. NPS 4 inch and NPS 5 inch: 60 inches with 5/8 inch rod.
 - 4. NPS 6 inch and NPS 8 inch: 60 inches with 3/4 inch rod.
 - 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
 - F. Provide supports for vertical cast-iron soil piping every 12 feet, at base of stack and at mid-point of each floor and at floor decks.

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- G. Provide hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 inch: 72 inches with 3/8 inch rod.
 - 2. NPS 1-1/2 inch and NPS 2 inch: 96 inches with 3/8 inch rod.
 - 3. NPS 2-1/2 inch: 108 inches with 1/2 inch rod.
 - 4. NPS 3 inch: 10 feet with 1/2 inch rod.
- H. Provide supports for vertical copper tubing every 10 feet, at base of stack and at midpoint of each floor and at floor decks.
- I. Provide supports for vertical PVC piping every 48 inches minimum, at base of stack and at each floor deck.
- J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by the Plumbing Code of New York State.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Provide test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - 5. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 6. Plumbing Equipment: Connect drainage piping as indicated. Provide a full port ball shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 inches and larger.
- C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- D. Make connections according to the following unless otherwise indicated:
 - 1. Provide unions, in piping NPS 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment.

3.7 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Provide written pressure test and inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10 foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Provide written reports for tests for the final O & M Manuals.

3.9 CLEANING AND PROTECTION

- A. Clean interior of piping and fittings. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Provide plugs in the ends of uncompleted sanitary sewer piping at the end of each work day and when work stops.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, storm, soil and waste piping NPS 4 inches and smaller shall be any of the following:
 - 1. Service weight class, cast iron hub and spigot soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, service weight cast-iron soil pipe and fittings; heavy duty shielded hubless-piping couplings; and coupled joints.
 - 3. Copper DWV tube, copper drainage fittings, and soldered joints. Do not use copper for urinal waste piping.
 - 4. Dissimilar Pipe Material Couplings: Shielded transition couplings.
 - 5. Refer to 3.2 above for conditions.
- C. Aboveground, storm, soil and waste piping NPS 5 inches and larger shall be any of the following:
 - 1. Service class, cast iron hub and spigot soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, service weight cast iron soil pipe and fittings; heavy duty shielded hubless-piping couplings; and coupled joints.
 - 3. Dissimilar Pipe Material Couplings: Shielded transition couplings.
- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service weight class, cast iron hub and spigot soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, service weight cast-iron soil pipe and fittings; heavy duty shielded hubless-piping couplings; and coupled joints.
 - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 4. Dissimilar Pipe-Material Couplings: Shielded transition couplings.
 - 5. Refer to 3.2 above for conditions.
- E. Underground, soil, waste, and vent piping shall be the following:
 - 1. Service weight class, cast iron hub and spigot soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, service weight cast-iron soil pipe and fittings; heavy duty shielded hubless-piping couplings; and coupled joints.
 - 3. Dissimilar Pipe Material Couplings: Shielded sheer ring transition couplings.

END OF SECTION 22 1316

SECTION 22 1319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts
2. Floor drains
3. Roof flashing assemblies
4. Miscellaneous sanitary drainage piping specialties
5. Flashing materials
6. Trap guard device
7. Trench drain

1.2 SUBMITTALS

- A. Product data and warranty information for each type of product indicated in this section and for the final O & M Manuals.
- B. Product Information: Product operation and maintenance data for the final O & M Manuals.

1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Provide sanitary waste piping specialties in compliance with Chapters 7, 8, 9 and 10 the Plumbing Code of New York State (2020).
- C. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020) and all New York State Amendments.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Cast-Iron Cleanouts (CO):
1. Basis-of-Design Product: Subject to compliance with requirements, provide Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc. Model #4402 or a comparable product by one of the following:
 - a. Wade.
 - b. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 3. Size: Same as connected drainage piping

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4. Body Material: Hub-and-spigot, cast iron soil pipe T-branch or hubless, cast iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, bronze plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts (FCO):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc. Model # 4028 or a comparable product by one of the following:
 - a. Wade.
 - b. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Heavy duty, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: as Required.
7. Outlet Connection: Inside calk or Spigot.
8. Closure: Bronze plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts (WCO):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc. Model # 4531 or a comparable product by one of the following:
 - a. Wade.
 - b. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised head, bronze plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, stainless steel cover plate with screw.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains: (FD-A) – Finished spaces, toilet rooms and shower rooms

1. Basis-of-Design Product: Subject to compliance with requirements, provide Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc. Model # 2010-A or a comparable product by one of the following:

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- a. Wade.
 - b. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
 3. Pattern: Floor drain.
 4. Body Material: Gray iron.
 5. Anchor Flange: Not required.
 6. Clamping Device: Flashing clamp.
 7. Outlet: 4 inch bottom.
 8. Coating on Interior and Exposed Exterior Surfaces: Acid resistant enamel.
 9. Sediment Bucket: Not required.
 10. Top or Strainer Material: 7 inch diameter nickel bronze.
 11. Top of Body and Strainer Finish: Nickel bronze.
 12. Top Shape: Round.
 13. Dimensions of Top or Strainer: 7 inch diameter.
 14. Top Loading Classification: Heavy Duty.
 15. Funnel: Not required.
 16. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection].
 17. Trap Material: Cast iron.
 18. Trap Pattern: Deep seal P-trap.
 19. Trap Features: Trap guard device. Refer to item 2.6

B. Cast-Iron Floor Drains: (FD-B) – Shower drain

1. Basis-of-Design Product: Subject to compliance with requirements, provide Oatey 151 Series # 42201 or a comparable product by one of the following:
 - a. Wade.
 - b. Zurn Plumbing Products Group; Specification Drainage Operation.
 - c. J.R. Smith.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray or cast iron.
5. Outlet: 2 inch bottom.
6. Top or Strainer Material: Chrome or stainless steel removable.
7. Trap Material: Cast iron.
8. Trap Pattern: Deep-seal P-trap.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.
 - c. Milcor Inc.; Commercial Products Group of Hart and Cooley Inc.

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- B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938 inch thick, copper flashing collar and skirt extending at least 10 inches from pipe, with galvanized steel boot reinforcement and counter flashing fitting.

1. Open Top Vent Cap: Without cap.
2. Low Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field installed, vandal-proof vent cap.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast iron, soil pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.
2. Size: Same as connected waste piping.
 - a. NPS 2: 4 inch minimum water seal.
 - b. NPS 2-1/2 and Larger: 5 inch minimum water seal.

C. Floor Drain, Trap Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

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1. Description: Counter flashing-type, cast iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.5 FLASHING MATERIALS

A. Copper Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625 inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469 inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938 inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent type, bituminous mastic.

2.6 TRAP GUARD DEVICE

A. Trap Guard:

1. Basis-of-Design Product: Subject to compliance with requirements, provide a Rectorseal - Sure Seal Model SS2009V or a comparable product by one of the following:
 - a. Mifab - MiGuard
 - b. Provent.
 - c. ProSet.
2. HDPE (high density polyethylene) housing with heavy duty proprietary silicone diaphragm and soft EPDM rubber sealing gasket. Floor rating ASSE 1072 AF GW.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Provide NPS 4 for larger drainage piping unless larger cleanout is indicated.

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2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate cleanouts at the base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, provide cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, provide cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Provide floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 3. Provide floor drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 4. Provide individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
 5. Provide a trap guard device inside floor drain bodies below strainer.
 6. Provide vandal resistant tools, screwdrivers to RCSD Facilities.
- E. Provide roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- F. Assemble open drain indirect waste fittings and install with top of hub 2 inches above floor.
- G. Provide deep seal traps on floor drains and other waste outlets unless obstructed by ceilings, steel structure or ductwork.
- H. Provide floor-drains and floor sinks and seal with vapor barrier construction at floor slabs. Refer to Architectural Plans for floor construction.
- I. Provide air gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- J. Provide sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- K. Provide traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless a trap is indicated.

- L. Provide trap guard devices in all floor drains bodies below strainer.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Provide piping adjacent to plumbing equipment to allow removal, service and maintenance.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Copper Sheets: Braze joints of copper sheets 6.0-lb/sq. ft., 0.0938 inch thickness or thicker. Solder joints of copper sheets 4.0-lb/sq. ft., 0.0625 inch thickness or thinner.
- B. Provide sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Provide flashing for piping passing through roofs with counter flashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Provide plugs in the ends of uncompleted sanitary sewer piping at the end of each work day or when work stops.

END OF SECTION 22 1319

SECTION 22 1423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleanouts
2. Flashing materials.
3. Roof Drain

1.2 SUBMITTALS

- A. Product data and warranty information for each type of product indicated in this section and for the final O & M Manuals.
- B. Product Information: Product operation and maintenance data for the final O & M Manuals.

1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Provide storm drainage piping specialties in compliance with Chapter 11 of the International Plumbing Code of New York State (2015).

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Cast Iron Cleanouts (CO):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Specification Drainage Operation Series 1440 or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast iron soil pipe T-branch or hubless, cast iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts (FCO):

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1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Specification Drainage Operation Series 1400-BP or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Tyler Pipe; Wade Div.
2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Inside calk or Spigot.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, service class, cast iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts (WCO):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Specification Drainage Operation Series 1441 or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast iron soil pipe T-branch or hubless, cast iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, drilled and threaded with brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
8. Wall Access: Round, nickel-bronze wall installation frame and cover.

2.2 FLASHING MATERIALS

- A. Copper Sheet: ASTM B 152/B 152M, 12 oz. /sq. ft.
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04 inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

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- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40 mil minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.
- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.

2.3 ROOF DRAIN

A. Cast-Iron Roof Drains (RD):

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Specification Drainage Operation Series Z-121 Cast-Iron, Large-Sump, 12 inches diameter roof drain, cast iron bodies with combination membrane flashing clamp/gravel guard and surface deck mounting plate or a comparable product by one of the following:
 - a. Josam Company; Josam Division.
 - b. MIFAB, Inc.
 - c. c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Division
- 2. Body Material: Coated Cast iron.
- 3. Dimension of Body: 12 - inches diameter drains.
- 4. Combination Flashing Ring and Gravel Stop: Required.
- 5. Flow-Control Weirs: Not required.
- 6. Outlet: 3 or 4 inch bottom outlet as per plans.
- 7. Extension Collars: Not required.
- 8. Under deck Clamp: Required.
- 9. Expansion Joint: Not required.
- 10. Sump Receiver Plate: Not required.
- 11. Dome Material: Cast iron.
- 12. Perforated Gravel Guard: Not required.
- 13. Vandal-Proof Dome: Not required.
- 14. Basis of Design Manufacturer: Zurn Industries Model Z-121 or approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
 - 1. Provide cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
 - 3. Locate cleanouts at minimum intervals of 50 feet dimension for piping NPS 4 and smaller and 100 feet for larger piping.

4. Locate cleanouts at base of each vertical storm stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Provide test tees, (wall cleanouts) in vertical storm conductors and 18 to 24 inches above floor. Provide cleanout cover plate or access door in wall.
- E. Provide sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 1. Solder joints of 4.0-lbs. / square foot of copper, 0.0625 inch thickness or thinner.
 2. Copper Sheets: Solder joints of copper sheets.
- B. Provide sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Fabricate and install flashing and pans, sumps, and other drainage shapes.
- F. Provide copper or galvanized steel pans with 1 inch indirect waste drains as required above electrical equipment located below domestic plumbing piping.

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Provide plugs in the ends of uncompleted storm sewer piping at the end of each work day or when work stops.

END OF SECTION 22 1423

SECTION 22 3400 - FUEL-FIRED, DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial, direct vent, gas-fired, storage type domestic water heaters.
2. Domestic water heater accessories.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide domestic water heater system, expansion tank, mixing valve and recirculation pump in compliance with Chapter 5 of the plumbing Plumbing Code of New York State including New York State Amendments (2020).
- B. Provide gas piping and venting in compliance with the Fuel Gas Code of New York State including New York State Amendments (2020).

1.3 SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater, expansion tank and accessories indicated in this section.
- B. Shop Drawings:
 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Product warranties for each product listed in this section.
- D. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- E. Source quality-control reports.
- F. Field quality-control reports and test reports.
- G. Operation and maintenance data for the final O & M Manuals.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA 90.1 Compliance: Fabricate and label fuel-fired, domestic water heaters to comply with ASHRAE/IESNA 90.1.

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C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, NSF 62 Annex G and NSF 372 "Drinking Water System Components - Health Effects." Components of manufacture and materials of construction exposed to drinking water shall not exceed a lead content of 0.5 percent by weighted average.

1.5 WARRANTY

A. Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Gas-Fired, Storage, Domestic Water Heaters:
 - 1) Storage Tank: Five years minimum.
 - 2) Controls and Other Components: Two year(s) minimum.
 - b. Expansion Tanks: Five years minimum.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Power-Vent, Gas-Fired, Storage, Domestic Water Heaters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide an A.O. Smith Model BTH-150A direct vent minimum 98% efficient water heater or comparable product by one of the following.
 - a. Lochinvar Corporation
 - b. Bradford White
 - c. LAARS Heating Systems Company
2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Water Heater Construction: ASME-code steel with 150 psig working pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 1-1/2 inches and Smaller: Threaded ends according to ASME B1.20.1.
 - b. Lining: Glass complying with NSF 61 barrier materials for potable water tank linings, including extending lining into and through tank fittings and outlets.

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- c. 100 gallon tank.
 - d. 173 GPH recovery at 100 degree F. rise.
 - e. 150,000 BTU/H gas input.
 - f. Venting: Provide a minimum 4 inch CPVC solid core schedule 40 exhaust and air intake piping only. Schedule 40 ABS is also acceptable for exhaust piping.
4. Factory-Installed Storage Tank Appurtenances:
- a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-gas fuel.
 - g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
5. Special Requirements: Minimum NSF 5 construction.
6. Power-Vent System: Exhaust fan, interlocked with burner.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts Regulator DETA-12; or comparable product by one of the following:
 - a. AMTROL Inc.
 - b. Flexcon Industries.
 - c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - d. State Industries.
 - e. Taco, Inc.
 - f. Bell & Gossett
- 2. Description: ASME code rated, steel, pressure rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air pre-charge to minimum system operating pressure at tank.
- 3. Construction:

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- 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.
4. Capacity and Characteristics:
- a. Working-Pressure Rating: 150 psig.
 - b. Capacity Acceptable: 11.7 gallons minimum capacity, 3.1 gallons acceptance factor.
 - c. Air Pre-charge Pressure: 50 psi Inlet system pressure.

B. Domestic-Water Heater Neutralizer Kit

1. Basis-of-Design Product: Subject to compliance with requirements, provide A.O. Smith CNS-2 neutralization kit; or comparable product by one of the following:
- a. Lochinvar Corporation
 - b. Bradford White
 - c. LAARS Heating Systems Company

2.3 DOMESTIC-WATER HEATER ACCESSORIES

- A. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- B. Heat-Trap Fittings: ASHRAE 90.2.
- C. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.
- D. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.
- E. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
 - 1. Gas-Fired, Domestic Water Heaters: ANSI Z21.22/CSA 4.4-M.
- F. Base: Provide 4 inch high concrete base below unit to support water heater above floor.

2.4 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic water heaters to minimum of one and one-half times pressure rating before shipment.

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- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- D. Provide written test and inspection reports for the final O & M Manuals.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Provide domestic-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.
 - 1. Provide shutoff valves on domestic water supply piping to domestic water heaters and on domestic hot water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General Duty Valves for Plumbing Piping."
- B. Provide gas-fired, domestic water heaters according to the Fuel Gas Code of New York State including New York State Amendments (2020) and Chapter 5 of the Plumbing Code of New York State including New York State Amendments (2020).
 - 1. Provide lubricated plug type gas shutoff valves on gas supply piping to gas-fired, domestic water heaters without shutoff valves in a visible and accessible location from a standing position on the floor.
 - 2. Provide automatic gas valves on gas supplies to gas-fired, domestic water heaters if required for operation of safety control.
 - 3. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Division 23 Section "Facility Natural Gas Piping."
- C. Provide combination temperature-and-pressure relief valves in top portion of storage tanks. Provide 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. Provide thermometers on the inlet and outlet piping of each domestic water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gauges for Plumbing Piping."
- E. Provide piping type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting type heat traps.
- F. Fill domestic water heaters with water prior to activation of gas and burner. Open all system ball valves for flow to the system.
- G. Contractor shall activate domestic hot water recirculation pump, confirm flow and supply from hot water system in conjunction with water heater activation.
- H. Charge domestic-water expansion tanks with air to match building water pressure.

3.2 CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Division 22 Section "Domestic Water Piping."
- B. Comply with requirements for gas piping specified in Division 23 Section "Facility Natural Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties. Comply with submitted manufacturer's piping diagram and written installation requirements.
- D. Where installing piping adjacent to fuel-fired, domestic water heaters, allow space to facilitate removal of water heaters for replacement, service and maintenance. Arrange piping behind and above heaters for easy removal of domestic water heaters without obstructions from front for removal. Heater shall be provided with all manufacturers' required clearances in compliance with manufacturer's written installation manual instructions.
- E. Venting: Provide 4 inch CPVC solid core schedule 40 exhaust and air intake piping only. Schedule 40 ABS is also acceptable for exhaust piping. Piping shall not discharge near window openings or building mechanical HVAC fresh air intakes. Provide exhaust and intake piping in compliance with submitted manufacturer's written installation manual instructions. Joint preparation and joining materials shall be suitable for high temperature exhaust. Vents shall extend above roof line, be flashed and fitted with turned down elbows.
- F. Contractor shall coordinate the locations of required power connections and sources with Division 26.

3.3 IDENTIFICATION

- A. Identify system components including heater, hot water re-circulation pumps and expansion tank with signs. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Provide tests and inspections. Refer to project Commissioning requirements documents.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing of equipment.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 5. Contractor shall field verify and adjust delivery water temperatures at water heater to building mixing valve and plumbing fixtures. Supply temperature to the building thermostatic mixing valve shall not exceed 140 degrees F. Supply temperature to fixtures

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shall not exceed 110 degrees F. Provide test and inspection reports for the final O & M Manual.

6. Contractor shall field verify all system thermometers and temperature settings. Replace thermometers that are damaged or not working.
 7. Contractor shall adjust all system balance valves while flowing hot water in the building to provide uniform flow throughout the system and minimize delivery time of hot water to the fixtures.
- B. Domestic water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- C. Provide written test and inspection reports for the final O & M Manuals.

3.5 DEMONSTRATION

- A. Engage the water heater manufacturer's factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain direct vent commercial, gas-fired, storage, domestic water heater.

END OF SECTION 22 3400

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets for lavatories and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Water closets.
7. Urinals.
8. Lavatories.
9. Sinks.
10. Janitor Sinks
11. Brass products.
12. Showers.

1.3 DEFINITIONS

- A. CPVC: Chlorinated poly vinyl chloride plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- D. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation, Maintenance Data and Warranties: For all plumbing fixtures to include product literature, warranties and maintenance manuals for the final O & M Manuals.

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- D. Warranties: Product warranties supplied on a single listing sheet for all products specified in this Section and for the final O & M Manuals.
- E. NSF Compliance: ANSI/NSF 61, NSF 62 Annex G and NSF 372 for valve materials for potable water service. Lead content shall not exceed 0.25 percent maximum by weighted average.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020) and all New York State Amendments.
- 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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Plastic Mop Service Basins: ANSI Z124.6.
 - 2. Stainless Steel Commercial, Handwash Sinks: NSF 2 construction.
 - 3. Vitreous China Fixtures: ASME A112.19.2M.
 - 4. Water Closet, Flush Valve: ASME A112.19.5.
 - 5. Backflow Protection Devices for Faucets with Hose Thread Outlet: ASME A112.18.3M.
 - 6. Faucets: ASME A112.18.1.
 - 7. Hose Connection Vacuum Breakers: ASSE 1011.
 - 8. Hose Coupling Threads: ASME B1.20.7.
 - 9. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 10. NSF Potable Water Materials: NSF 61, NSF – 62-Annex G and NSF 372.
 - 11. Pipe Threads: ASME B1.20.1.

12. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
13. Supply Fittings: ASME A112.18.1.
14. Brass Waste Fittings: ASME A112.18.2.
15. Combination, Pressure-Equalizing and Thermostatic Control Anti-scald Faucets: ASSE 1016.
16. Faucets: ASME A112.18.1.
17. High Temperature Limit Controls for Thermal Shock Preventing Devices: ASTM F 445.
18. Hose Coupling Threads: ASME B1.20.7.
19. Manual Control Anti-scald Faucets: ASTM F 444.
20. Thermostatic Control Anti-scald Faucets: ASTM F 444 and ASSE 1016.
21. Atmospheric Vacuum Breakers: ASSE 1001.
22. Brass and Copper Supplies: ASME A112.18.1.
23. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
24. Off-Floor Fixture Supports: ASME A112.6.1M.
25. Plastic Toilet Seats: ANSI Z124.5.
26. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 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. Faucet Washers and O-Rings: Equal to 2 of each type and size installed.
 2. Faucet Cartridges and O-Rings: Equal to 2 of each type and size installed.
 3. Flushometer Valve, Repair Kits: Equal to 2 of each type installed, but no fewer than 12 of each type.
 4. Toilet Seats: Equal to 2 of each type installed.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

- A. Lavatory Faucets: (LAV)
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Chicago Model 802-317-ABCP or a comparable product by one of the following:
 - a. Chicago
 - b. T & S Brass and Bronze Works, Inc.
 - c. Zurn Plumbing Products Group; Commercial Brass Operation.
 2. Description: Chrome plated cast brass, low lead, manual operation faucet. Includes 5 inch spout, concealed below deck mixing valve, 4 inch centers, coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid body low lead content cast brass. Hollow metal bodies not acceptable.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 0.5 gpm aerator, vandal resistant.
 - d. Hole Centers: 4 inch.
 - e. Mounting: Deck, exposed

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- f. Inlet(s): stainless steel hoses, NPSM 1/2 inch inlets and coupling for 3/8" or 1/2" flexible riser.
- g. Spout: Brass rigid type.
- h. Vandal resistant spout outlet: Aerator, spray, 0.5 gpm.
- i. Operation: 4 inch solid brass wrist blade handles.

2.2 SINK FAUCETS

A. Sink Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Chicago Faucets Model 1100-HA8-317ABCP or a comparable product by one of the following:
 - a. T & S Brass.
 - b. Zurn Plumbing Products Group; Commercial Brass Operation.
2. Description: ADA Compliant kitchen sink faucet with high arc-swing spout, 2.2 gpm pressure compensating aerator spray. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial grade, low lead content solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 2.2 gpm, unless otherwise indicated.
 - d. Mixing Valve: 317 indexed wrist blade handles (two).
 - e. Hole Centers: 8 inches.
 - f. Mounting: Deck.
 - g. Handle(s): Wrist blade, solid brass, 4 inches.
 - h. Inlet(s): NPSM 1/2 inch coupling nut for 3/8 inch.
 - i. Spout Type: 8 inch projecting out swing type, shaped tube, solid brass.
 - j. Spout Outlet: Aerator.
 - k. Operation: Quatern operating cartridges.

2.3 FLUSHOMETERS

A. Flushometers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sloan Valve manual operated flush valves or a comparable product by one of the following:
 - a. Coyne & Delany Co.
 - b. Delta Faucet Company.
 - c. Zurn Plumbing Products Group; Commercial Brass Operation.
2. Description: Flushometer for urinal or water closet type fixture. Include brass body with corrosion-resistant internal components, non-hold open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
 - a. Internal Design: Diaphragm operation.
 - b. Style: Exposed.

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- c. Inlet Size: NPS 3/4 inch for urinal, NPS 1 inch for water closet.
- d. Trip Mechanism: Manual solid brass lever.
- e. Consumption: 0.125 gallons per flush for urinal, 1.28 gallons per flush for the water closet.
- f. Tailpiece Size: NPS 3/4 for urinal, NPS 1-1/2 inch and standard length to top of bowl.
- g. Urinal Flushometer: Sloan Royal Model 186-0.125.
- h. Water Closet Flushometer: Sloan Royal Uppercut Model WES-111.

2.4 TOILET SEATS

A. Toilet Seats:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Church Seats Model 9500 NSCC or a comparable product by one of the following:
 - a. American Standard Companies, Inc.
 - b. Bemis Manufacturing Company.
 - c. Centoco Manufacturing Corp.
 - d. Eljer.
 - e. Olsonite Corp.
 - f. Sanderson Plumbing Products, Inc.; Beneke Div.
 - g. Sperzel.
- 2. Description: Toilet seat for water closet-type fixture.
 - a. Material: Molded, solid plastic with antimicrobial agent.
 - b. Configuration: Open front without cover.
 - c. Style: Elongated.
 - d. Hinge Type: Stainless Steel, self-sustaining check hinges.
 - e. Class: Heavy duty commercial solid plastic.
 - f. Color: White.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Engineered Brass Co.
 - b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
 - c. McGuire Manufacturing Co., Inc.
 - d. Plumberex Specialty Products Inc.
 - e. TCI Products.
 - f. TRUEBRO, Inc.
 - g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
- 2. Description: Manufactured plastic wraps for covering plumbing fixture hot and coldwater supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.6 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Josam Company.
 2. MIFAB Manufacturing Inc.
 3. Smith, Jay R. Mfg. Co.
 4. Tyler Pipe; Wade Div.
 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Urinal Supports:
1. Description: Urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall mounting, urinal-type fixture. Include steel uprights with feet.
 2. Accessible Fixture Support: Include rectangular steel uprights.
 3. Basis of Design Manufacturer: Zurn Industries Model ZN-1221 or ZN-1222 or Engineer approved equal.
- C. Lavatory Supports:
1. Description: Lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
 2. Accessible-Fixture Support: Include rectangular steel uprights.
 3. Basis of Design Manufacturer: Zurn Industries Model ZN-1231-EZ or ZN-1231-EZR or Engineer approved equal.

2.7 BRASS PRODUCTS

- A. Traps, Stops, Supplies:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Commercial Brass Operation or a comparable product by one of the following:
 - a. Central Brass.
 - b. Delta Faucet Company.
 - c. McGuire Brass.
 - d. Wolverine Brass
 - e. T & S Brass and Bronze Works, Inc.
 2. Description: Commercial grade, heavy duty, low lead content chrome plated brass products with vandal resistant hardware.
 - a. Traps: 17 gage cast brass chrome plated with brass slip-nut and deep steel flange, New York State compliant, with brass cleanout plug. Zurn Z-8730-PC to Z-8731-PC series or approved equal.

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- b. Supplies: Stainless steel hose flexible connectors with brass quarter turn stop valves and loose removable tee keys. Zurn Z-8800LRQ-8860-12-PC to Z8809LRKQ-8860-12-PC series or approved equal.
- c. Trap offsets and sink strainers: ADA compliant trap off-sets, 17 gage cast brass body off-set for wheel chair use, brass nuts, chrome plated. Zurn Z-8747-PC to Z-8750A-PC or approved equal.
- d. Basket strainers: Sink basket strainer, chrome plated brass body with locknut and four prong stainless steel basket and neoprene stopper. Zurn ZTT-461-W-PC or approved equal.
- e. Offset lavatory strainers: Chrome plated brass open grid drain strainer and chrome plated cast brass elbow. 17 gage chrome plated tubular brass offset tailpiece for sink depth to 2-1/2 inches. Zurn Z-8746-PC or approved equal.

2.8 WATER CLOSETS

A. Water Closets (WC-A): (ADA compliant mounting height)

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Kohler Model K-96057 or a comparable product by one of the following:
 - a. Gerber.
 - b. Kohler Co.
 - c. Mansfield Plumbing Products, Inc
- 2. Description Accessible, floor mounted, floor outlet, and vitreous china fixture designed for flushometer valve operation.
 - a. Style: One piece.
 - 1) Bowl Type: Elongated with siphon jet design.
 - 2) Design Consumption: 1.1 to 1.6 gallons per flush.
 - 3) Trip Mechanism: Manual.
 - 4) Color: White.
 - b. Supply: NPS 1 chrome-plated brass or copper with screwdriver stop.
 - c. Flushometer: Sloan Valve manual operated Sloan Model 111.
 - d. Toilet Seat: Church Seats Model 9500 NSCC.

B. Water Closets (WC-B):

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Kohler Kingston Model K-96053 or a comparable product by one of the following:
 - a. Gerber.
 - b. Kohler Co.
 - c. Mansfield Plumbing Products, Inc.
- 2. Description: floor mounted, floor outlet, vitreous china fixture designed for flushometer valve operation.
 - a. Style: One piece.

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- 1) Bowl Type: Elongated with siphon jet design.
- 2) Design Consumption: 1.1 to 1.6 gallons per flush.
- 3) Trip Mechanism: Manual.
- 4) Color: White.
- b. Supply: NPS 1 chrome-plated brass or copper with screwdriver stop.
- c. Flushometer: Sloan Valve manual operated Sloan Model 111
- d. Toilet Seat: Church Seats Model 9500 NSCC.

2.9 URINALS

A. Urinals, (UR-A) (ADA compliant mounting height):

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Kohler Bardon Model K-4991-ET or a comparable product by one of the following:
 - a. Gerber.
 - b. Kohler Co.
 - c. Mansfield Plumbing Products, Inc.
- 2. Description Accessible, wall mounting, bottom outlet, and vitreous china fixture designed for electric flushometer valve operation.
 - a. Type: Washout with extended shields.
 - b. Strainer or Trapway: Open trapway with integral trap.
 - c. Design Consumption: 0.125 gallons per flush.
 - d. Color: White.
 - e. Supply Spud Size: NPS 3/4.
 - f. Outlet Size: NPS 2.
 - g. Flushing Device: Fixture manufacturer's standard matching fixture.
 - a. Flushometer: Refer to 2.3.
 - b. Fixture Support: Refer to 2.6, urinal chair carrier.

B. Urinals, (UR-B):

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Kohler Bardon Model K-4991-ET or a comparable product by one of the following:
 - a. Gerber.
 - b. Kohler Co.
 - c. Mansfield Plumbing Products, Inc.
- 2. Description: Wall mounting, back outlet, vitreous china fixture designed for flushometer valve operation.
 - a. Type: Washout with extended shields.
 - b. Strainer or Trapway: Open trapway with integral trap.
 - c. Design Consumption: 0.125 gallons per flush.
 - d. Color: White.
 - e. Supply Spud Size: NPS 3/4.
 - f. Outlet Size: NPS 2.
 - g. Flushometer: Refer to 2.3.

h. Fixture Support: Refer to 2.6, urinal chair carrier.

C. Fixture Support: Refer to 2.6, Urinal chair carrier.

2.10 LAVATORIES

A. Lavatories, (LAV-A): (ADA compliant mounting height):

1. Basis-of-Design Product: Subject to compliance with requirements, provide a Kohler Model K-2005-L or a comparable product by one of the following:

- a. Gerber.
- b. Kohler.
- c. Mansfield Plumbing Products, Inc.

2. Description: Accessible, wall mounted, vitreous china fixture.

- a. Type: Flat rim with ledge.
- b. Rectangular Lavatory 21-1/4 inches by 18-1/8 inches.
- c. Faucet Hole Punching: Two holes, 4 inch center set.
- d. Faucet Hole Location: Top.
- e. Color: White.
- f. Faucet: Refer to item 2.1. Lavatory for separate drain.
- g. Supplies: Zurn Industries NPS 3/8 chrome-plated brass quarter turn stop valves with loose key stops.
- h. Drain: Grid with offset waste.
 - 1) Location: Near back of bowl.
- i. Drain Piping: NPS 1-1/4 by NPS 1-1/2 chrome-plated, cast-brass P-trap NPS 1-1/2, 0.045 inch thick tubular brass waste and off-set tailpiece to wall; and wall escutcheon.

B. Protective Shielding Guard(s): Required.

C. Lavatories, (LAV-B):

1. Basis-of-Design Product: Subject to compliance with requirements, provide a Kohler Model K-2005-L or a comparable product by one of the following:

- a. Gerber.
- b. Kohler.
- c. Mansfield Plumbing Products, Inc.

2. Description: Wall mounted, vitreous china fixture.

- a. Type: With back.
- b. Size: 21-1/4 inches by 18-1/8 inches.
- c. Faucet Hole Punching: Two holes, 4 inch center set.
- d. Faucet Hole Location: Top.
- e. Color: White.

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- f. Faucet: Refer to item 2.1. Lavatory for separate drain.
- g. Supplies: Zurn Industries NPS 3/8 chrome-plated, brass, quarter turn stop valves, with loose key stops.
- h. Drain: Grid.
 - 1) Location: Near back of bowl.
- i. Drain Piping: NPS 1-1/4 by NPS 1-1/2 chrome-plated, cast-brass P-trap; NPS 1-1/2, 0.045 inch thick tubular brass waste with off-set tailpiece to wall; and wall escutcheon.
- j. Fixture Support: Lavatory

2.11 SINKS – (ADA Compliant)

A. Sink (SK-A)

- 1. ECTSRAD33226BG – 33”x22”6” deep, Elkay double compartment stainless steel sink, 3 faucet hole configuration 18 gage, self-rims.
- 2. Chicago Faucets Model 1100-HA8-317ABCP.
- 3. 3/8 inch supply pipes with loose key control stops, cast brass escutcheons, flexible tube risers.
- 4. Metal grid drain, 1-1/2 inch tailpiece.
- 5. 1-1/2 inch x 1-1/2 inch adjustable P-trap, 17 gauge cast body, cleanout plug, slip inlet and tubing drain to wall, cast brass escutcheon.

2.12 JANITORS SINKS

A. Mop Basin (**MSS-1**):

- 1. Manufacturers: Subject to compliance with requirements, provide Swanstone model MS-2424 or approved equal, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Florestone Products Co., Inc.
 - b. Mustee, E. L. & Sons, Inc.
 - c. Zurn Industries, LLC.
- 2. Fixture:
 - a. Standard: ANSI Z124.6.
 - b. Material: Molded high density composite.
 - c. Type: Floor-mounting with rim guard.
 - d. Nominal Size: 24 by 24 inches.
 - e. Height: 10 inches.
 - f. Wall Guard: Stainless steel, on two sides.
 - g. Color: White.

3. Faucet: Manual faucet for mop basins.
 - a. Manufacturers: Subject to compliance with requirements, provide Chicago model 897-RCF or approved equal, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) American Standard.
 - 2) Sloan Valve Company.
 - 3) Zurn Industries, LLC.
 - b. Standard: ASME A112.18.1/CSA B125.1.
 - c. Features: Vandal proof, adjustable supply arms, integral check and stop valves for servicing, atmospheric vacuum breaker spout with 3/4 inch male hose thread, pail hook, and wall brace.
 - d. Body Type: Wall mounted, 8-inch body.
 - e. Body Material: Commercial, solid brass.
 - f. Finish: Chrome Plated.
 - g. Mounting Type: Wall, exposed.
 - h. Valve Handle(s): Lever.
 - i. Spout: Rigid type.
4. Drain: Grid, with NPS 3 center outlet.

2.13 SHOWERS

A. Shower, SHR-A (ADA):

1. Description: Shower floor and walls shall be part of the General Construction.
 - a. Drain Location: Center.
 - b. Accessibility Options: N/A.
 - c. Shower Valve: Refer to item 2.18.
 - d. Drain: Drain as per 221319. Grid, NPS 2 inch integral with base. Schluter polished stainless steel shower drain.

2.14 SHOWER VALVES / FAUCETS

A. Shower Faucets, SHR-A:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Symmons Industries, Inc. Model 1-901S-FSB-2.0
 - b. No equal
2. Description: Single-handle thermostatic/pressure-balance valve for shower. Include hot and cold water indicators; 5 foot stainless steel flexible hose and shower wand; wall bracket for wand; water supply check stops; and chrome metal shower head, arm, and flange.
 - a. Body Material: Solid brass

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- b. Finish: Polished chrome plate.
- c. Maximum Flow Rate: 2.0 gpm, unless otherwise indicated.
- d. Mounting: Concealed in wall.
- e. Anti-scald Device: Integral with mixing valve.
- f. Check Stops: Check valve type, integral with or attached to body; on hot and cold water supply connections.
- g. Supply Connections: NPS 1/2 Sweat.
- h. Shower Head Type: Chrome wall mounted and hand held with stainless steel hose.
- i. Accessories: Stainless steel grab bar, metal hose and hand shower unit
- j. Spray Pattern: Adjustable pattern, vandal resistant.

B. Shower Faucets, SHR-B:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Symmons Industries, Inc. Model 1-901S-2.0
 - b. No equal
2. Description: Single-handle thermostatic/pressure-balance valve for shower. Include hot and cold water indicators; water supply check stops; and chrome metal shower head, arm, and flange.
 - a. Body Material: Solid brass
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 2.0 gpm, unless otherwise indicated.
 - d. Mounting: Concealed in wall.
 - e. Anti-scald Device: Integral with mixing valve.
 - f. Check Stops: Check-valve type, integral with or attached to body; on hot and cold water supply connections.
 - g. Supply Connections: NPS 1/2 Sweat.
 - h. Shower Head Type: Chrome wall mounted and hand held with stainless steel hose.
 - i. Accessories: Stainless steel grab bar, metal hose and hand shower unit
 - j. Spray Pattern: Adjustable pattern, vandal resistant

PART 3 - EXECUTION

3.0 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine casework and cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed prior to installation and confirm any conflicts in writing with the Architect.
- C. Proceed with installations only after unsatisfactory conditions have been verified and corrected.

3.1 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Provide off-floor supports, affixed to building substrate, for wall mounting fixtures.
 - 1. Provide carrier supports with waste fitting and seal for back outlet fixtures.
 - 2. Provide carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Provide chair-type carrier supports with rectangular steel uprights for accessible fixtures.
 - 4. Provide carriers for water coolers in accordance with section 224700 "Water Coolers".
- C. Provide back-outlet, wall mounting fixtures onto waste fitting seals and attach to supports.
- D. Provide floor mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Provide wall mounting fixtures with tubular waste piping attached to supports.
- F. Provide floor mounting, back outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- G. Provide counter mounting fixtures in and attached to casework. Provide for sealant at perimeters as a uniform bead of caulk.
- H. Provide fixtures level and plumb according to written installation instructions and roughing-in drawings furnished by fixture manufacturer.
- I. Provide water supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Provide full port ball valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General Duty Valves for Plumbing Piping."
- J. Provide trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system. Provide trap off-sets to locate traps as close as possible to wall for ADA required clearances.
- K. Provide tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- L. Provide flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Provide sensors unobstructed by grab bars. ADA compliant faucets and handles shall be in locations that are easy for people with disabilities to reach.
- M. Provide toilet seats on water closets level, secure and aligned to elongated bowls.
- N. Provide fixture gaskets on all water closets and urinals at sanitary waste connections at walls or floors.

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- O. Provide faucet spout fittings with aerators meeting specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Locate faucet and flush valve transformers above ceiling or in adjoining storage room or janitor closet. Provide access door to allow servicing and removal. Locate any low voltage wiring devices high and as tight as possible on walls and to the underside of lavatories.
- Q. Provide water supply flow control fittings with specified flow rates in fixture supplies at stop valves.
- R. Provide P-traps on all fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- S. Provide escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Escutcheons for Plumbing Piping."
- T. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."
- U. Confirm that faucet centers and sink hole quantities and spacing match prior to providing product submittals.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.3 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.4 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

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- B. Operate and adjust all faucets and flush valves while flowing water. Fixtures shall be operational prior to final punch list inspections. Replace or repair any damaged or malfunctioning units and controls.
- C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.

3.5 CLEANING

- A. Provide for and clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
 - 3. Do not use cleaners with surfactants on fixtures or chrome finishes. Provide for soap and clean water to clean fixtures prior to final punch list inspections.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.6 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION – 22 4000

ITEM 627.0023 25**HEATING, VENTILATING, AND AIR CONDITIONING****1. DESCRIPTION:**

1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.

1.04 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.

5.02 Detailed Estimate:

- A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
- B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
- C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.

5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0023 25**HEATING, VENTILATING, AND AIR CONDITIONING****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

A.	Section 230500	COMMON WORK RESULTS FOR HVAC
B.	Section 230513	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
C.	Section 230529	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
D.	Section 230548.13	VIBRATION CONTROLS FOR HVAC
E.	Section 230593	TESTING, ADJUSTING AND BALANCING
F.	Section 230713	DUCT INSULATION
G.	Section 233113	METAL DUCTS
H.	Section 233300	AIR DUCT ACCESSORIES
I.	Section 233713.23	DIFFUSERS AND GRILLES
J.	Section 237416.11	PACKAGED, SMALL CAPACITY, HVAC UNIT WITH GAS HEAT

1.02 This item shall include, but not be limited to, the following:

- A. HVAC units needed for the building's addition
- B. Ductwork for the building's addition
- C. Diffusers, registers, and grilles to be placed in the ceiling of the addition

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Motors.
2. Duct-thermometer mounting brackets.
3. Pressure gauges, dial type.
4. Gauge attachments.
5. Test plugs.
6. Test-plug kits.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product, excluding motors which are included in Part 1 of HVAC equipment Sections.
 - a. Include construction details, material descriptions, and dimensions of individual components, and finishes.
 - b. Include operating characteristics and furnished accessories.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of motor, meter, and gauge.
- B. Welding certificates.
- C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of submitted/approved HVAC equipment and accessories to include in operation and maintenance manuals, and warranty documents.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1.6 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
1. Motor controllers.
 2. Torque, speed, and horsepower requirements of the load.
 3. Ratings and characteristics of supply circuit and required control sequence.
 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 MOTORS

A. Motor Requirements, General:

1. Content includes motors for use on alternating-current power systems of up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturers for field installation.
2. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
3. Comply with NEMA MG 1 unless otherwise indicated.
4. Comply with IEEE 841 for severe-duty motors.

B. Motor Characteristics:

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 ft. (1000 m) above sea level.
2. 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 factors.

C. Polyphase Motors:

1. Description: NEMA MG 1, Design B, medium induction motor.
2. Efficiency: Premium Efficient, as defined in NEMA MG 1.
3. Service Factor: 1.15.
4. Multispeed Motors: Variable torque.
 - a. For motors with 2:1 speed ratio, consequent pole, single winding.
 - b. For motors with other than 2:1 speed ratio, separate winding for each speed.
5. Multispeed Motors, Two Winding: Separate winding for each speed.
6. Rotor: Random-wound, squirrel cage.
7. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
8. Temperature Rise: Match insulation rating (i.e. Class F insulation with Class B temperature rise).
9. Insulation: Class F.

10. Code Letter Designation:

- a. Motors 15 Hp and Larger: NEMA starting Code F or Code G.
- b. Motors Smaller Than 15 Hp: Manufacturer's standard starting characteristic.

11. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

D. Additional Requirements for Polyphase Motors:

1. Motors Used with Reduced Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in a motor terminal box, suited to control method.
2. Motors Used with Variable-Frequency Controllers:
 - a. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time-rise pulses produced by pulse-width-modulated inverters.
 - b. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - c. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

E. Single-Phase Motors:

1. Motors larger than 1/20 hp must be one of the following, to suit starting torque and requirements of specific motor application:
 - a. Permanent-split capacitor.
 - b. Split phase.
 - c. Capacitors start, inductor run.
 - d. Capacitors start, capacitors run.
2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Pre-lubricated, anti-friction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 hp and Smaller: Shaded-pole type.
5. 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 will automatically reset when motor temperature returns to normal range.

F. Electronically Commutated Motors:

1. Microprocessor-Based Electronic Control Module: Converts 120 V single-phase AC power to three-phase DC power to operate the brushless DC motor.
2. Three-phase power motor module with permanent magnet rotor.
3. Digital speed controller/LED display.
4. Building Automation System Interface: Via Digital Serial Interface (DSI).

PART 3 - EXECUTION

3.1 INSTALLATION OF METERS AND GAUGES

- A. Install duct-thermometer-mounting brackets in walls of ducts. Attach to duct with screws.
- B. Install thermometers in the following locations:
 - 1. Outside-, return-, supply-, and mixed-air ducts.

3.2 CONNECTIONS

- A. Install meters and gauges adjacent to machines and equipment to allow space for service and maintenance of meters, gauges, machines, and equipment.

3.3 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gauges to proper angle for best visibility.

3.4 THERMOMETER APPLICATION

- A. Thermometers at outside-, return-, supply-, and mixed-air ducts are to be the following:
 - 1. Liquid-filled/Sealed, bimetallic-actuated type.
 - 2. Direct/Remote-mounted, metal/plastic-case, vapor-actuated type.
 - 3. Compact/Industrial-style, liquid-in-glass type.
 - 4. Direct/Remote-mounted, light-activated type.
- B. Thermometer stems are to be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE APPLICATION

- A. Scale Range for Air Ducts:
 - 1. Minus 40 to plus 160 deg F and minus 40 to plus 100 deg C.
 - 2. 0 to 100 deg F and minus 20 to plus 50 deg C.
 - 3. 0 to 150 deg F and minus 20 to plus 70 deg C.
 - 4. 0 to 250 deg F and 0 to 150 deg C.
 - 5. 20 to 240 deg F and 0 to 150 deg C.

END OF SECTION 230500

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.
- B. 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.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. 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.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed 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 Variable-Frequency Controllers:
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
 - 2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. 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.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment hangers.
 - 2. Equipment supports/plenum/curb.
- B. Related Requirements:
 - 1. Section 230548.13 "Vibration Controls for HVAC" for vibration isolation devices.
 - 2. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer (PE) in New York State. Show fabrication and installation details and include calculations for the following: include Product Data for components:
 - 1. Metal hanger systems.
 - 2. Equipment supports/plenum/curb.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and support for HVAC equipment shall withstand the effects of gravity loads and stress within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design equipment supports/plenum/curb with insulation capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 EQUIPMENT SUPPORTS

- A. Description: Welded, shop fabricated equipment support/plenum/curb made from structural carbon-steel shapes with insulation.

2.3 MATERIALS

- A. Aluminum: ASTM B221 (ASTM B221M).
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.
- F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, no shrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs. (90 kg).

3.2 HANGER AND SUPPORT INSTALLATION

- A. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- B. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- C. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel hangers to suspend equipment from structure overhead or to support equipment above floor with insulated plenum/curb.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment support/hangers.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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 overlapping.
 - 3. Remove the welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.6 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use the same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint with brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

- A. Use hangers and supports with galvanized metallic coatings for equipment/VAV boxes/HVAC unit that will not have field-applied finish.

END OF SECTION 230529

SECTION 230548.13 - VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Elastomeric hangers.
4. Spring hangers.
5. Snubbers.
6. Post-installed concrete anchors.
7. Concrete inserts.

1.3 DEFINITIONS

- A. IBC: International Building Code.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Include load rating for each wind-force-restraint fitting and assembly.
3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and wind-force-restraint component.
4. Annotate to indicate application of each product submitted and compliance with requirements.
5. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

- B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal:

1. For each wind-load protection device that is required by this Section or is indicated on Drawings, submit the following:
 - a. Vibration Isolator and Wind-Load-Restraint Selection: Select vibration isolators, wind-load restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data.
 - b. Concrete Anchors and Inserts: Include calculations showing anticipated wind loads.
 - c. Wind-Load Design Calculations: Submit all static and dynamic loading calculations prepared under "Wind-Load Design Calculations" Paragraph in "Performance Requirements" Article.
 - d. Qualified Professional Engineer: All designated-design submittals for wind-restraint calculations are to be signed and sealed by qualified professional engineer responsible for their preparation.
2. Wind-Restraint Detail Drawing:
 - a. Design Analysis: To support selection and arrangement of wind restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during wind events. Indicate association with vibration isolation devices.
 - c. Coordinate vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.
3. All delegated-design submittals for wind-restraint detail Drawings are to be signed and sealed by qualified professional engineer responsible for their preparation.
4. Product Listing, Preapproval, and Evaluation Documentation: By UL/FM Approvals/OSHPD/an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and basis for approval (tests or calculations).
5. Design Calculations for Vibration Isolation Devices: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC equipment with other systems and equipment in the vicinity, including other supports and restraints.
- B. Qualification Data: For testing agency.
- C. Welding certificates.
- D. Air-Spring Mounting System Performance Certification: Include natural frequency, load, and damping test data performed by an independent agency.

- E. Field quality-control reports.
- F. Wind-Force Performance Certification: Provide special certification for HVAC components subject to high wind exposure and impact damage and designated on Drawings or in the Specifications to require wind-force performance certification.
 - 1. Provide equipment manufacturer's written certification for each designated HVAC device, stating that it will remain in place and operable following the design wind event and comply with all requirements of authorities having jurisdiction.
 - 2. Provide manufacturer's written certification for each designated louver, damper, or similar device, stating that it will remain in place and protect opening from penetration of windborne debris and comply with all requirements of authorities having jurisdiction.
 - 3. Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.
 - 4. The following HVAC systems and components require special certification for high wind performance. Written special certification of resistance to the effects of high wind force and impact damage must be provided by manufacturer:
 - a. HVAC Unit.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-spring mounts and restrained-air-spring mounts to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7 and is acceptable to authorities having jurisdiction.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Wind-Load-Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: UL product listing/FM Approvals/an evaluation service member of ICC-ES/an agency acceptable to authorities having jurisdiction].

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer.

Manchester Addition and Renovations to Maintenance Section, MP 340.15

1. Wind-Load Performance: Equipment shall withstand the effects of high wind events determined in accordance with ASCE/SEI 7-05/ASCE/SEI 7-10/ASCE/SEI 7-16/NYSBC.

B. Wind-Load Design Calculations:

1. Perform calculations to obtain force information necessary to properly select wind-load-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in [ASCE/SEI 7-05] ASCE/SEI 7-10/ASCE/SEI 7-16/Insert ASCE/SEI 7 edition or other wind-force calculation method required by authorities having jurisdiction. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is intended as referenced throughout the Section Text unless otherwise noted.
 - a. Factors indicated below that are specific to individual pieces of equipment must be obtained by Contractor and must be included in individual component submittal packages.
 - b. Coordinate design wind-load calculations with vibration isolation requirements. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.
2. Design wind pressure "p" for external sidewall-mounted equipment such as louvers is to be calculated by Delegated-Design Contractor using methods in ASCE/SEI 7-16, Ch. 30. Perform calculations in accordance with one of the following, as appropriate:
 - a. PART 1: Low-Rise Buildings.
 - b. PART 2: Low-Rise Buildings (Simplified).
 - c. PART 3: Buildings with "h" are less than 60 feet (18.3 m).
3. Design wind pressure "p" for HVAC equipment is to be calculated by Delegated-Design Contractor using methods in ASCE/SEI 7-16, Ch. 30, PART 6: Building Appurtenances and Rooftop Structures and Equipment.
 - a. Risk Category: II.
 - b. h = Mean Roof Height: .
 - c. V = Basic/Nominal Wind Speed: 85 mph; Ultimate Design Wind Speed: 110 mph (3 second gust).
 - d. K_d = Wind Directionality Factor:.
 - e. Exposure Category: B.
 - f. K_{zt} = Topographic Factor:.
 - g. K_e = Ground Elevation Factor:.
 - h. K_z = Velocity Pressure Exposure Coefficient (Evaluated at Height z):.
 - i. K_h = Velocity Pressure Exposure Coefficient (Evaluated at Height h):.
 - j. q_z = Velocity Pressure: Value calculated by delegated wind-load design Contractor using methods detailed in ASCE/SEI 7-16 Section 26.10.1 or other source approved by authorities having jurisdiction.
 - k. q_h = Velocity Pressure: Value calculated by delegated wind-load design Contractor using methods detailed in ASCE/SEI 7-16 Section 26.10.1 or other source approved by authorities having jurisdiction.
 - l. G = Gust-Effect Factor: 0.85.
 - m. Enclosure Classification: .
 - n. GC_{pi} = Internal Pressure Coefficient:.

Manchester Addition and Renovations to Maintenance Section, MP 340.15

1. Design wind force "F" for external sidewall-mounted equipment such as ductwork/louvers is to be calculated by Delegated-Design Contractor using methods in ASCE/SEI 7-05, Ch. 6.
 - a. I = Importance Factor: .
 - b. h = Mean Roof Height: .
 - c. V = Basic Wind Speed: 100 mph.
 - d. K_d = Wind Directionality Factor: .
 - e. Exposure Category: B/C/D.
 - f. K_{zt} = Topographic Factor: .
 - g. K_z = Velocity Pressure Exposure Coefficient (Evaluated at Height z): .
 - h. K_h = Velocity Pressure Exposure Coefficient (Evaluated at Height h): .
 - i. q_z = Velocity Pressure at Height z : Value calculated by delegated wind-load design Contractor using methods detailed in ASCE/SEI 7-05 Section 6.5.10 or other source approved by authorities having jurisdiction.
 - j. q_h = Velocity Pressure at Roof Height h : Value calculated by delegated wind-load design Contractor using methods detailed in ASCE/SEI 7-05 Section 6.5.10 or other source approved by authorities having jurisdiction.
 - k. G = Gust-Effect Factor: 0.85.
 - l. GC_{pi} = Internal Pressure Coefficient: .
 - m. GC_p = External Pressure Coefficient: .
 - n. C_f = Force Coefficient: Value determined by delegated wind-load design Contractor from ASCE/SEI 7-05, Figures 6-21 through 6-23 or other source approved by authorities having jurisdiction.
 - o. A_f = Projected Area Normal to the Wind: Except where " C_f " is specified for the actual surface area. Value determined by delegated wind-load design Contractor from equipment submittal or manufacturer.

- C. Consequential Damage: Provide additional restraints for HVAC components or anchorage of floor-, or wall-mounted HVAC components as indicated in ASCE/SEI 7-05/ASCE/SEI 7-10/ASCE/SEI 7-16 so that failure of a non-essential or essential HVAC component will not cause the failure of any other essential architectural, mechanical, or electrical building component.

- D. Component Supports:
 1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.

- 2.2 ELASTOMERIC ISOLATION PADS
 - A. Elastomeric Isolation Pads:
 1. Kinetic Noise Control, Inc. or approved equal.
 2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 3. Size: Factory or field cut to match the requirements of supported equipment.
 4. Minimum deflection as indicated on Drawings.
 5. Pad Material: Oil- and water-resistant rubber.
 6. Infused nonwoven cotton or synthetic fibers.

7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient and elastomeric.
 - a. Infused nonwoven cotton or synthetic fibers.

2.3 ELASTOMERIC ISOLATION MOUNTS

A. Elastomeric Isolation Mounts:

B.

1. Kinetic Noise Control, Inc. or approved equal.
2. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
3. Minimum deflection as indicated on Drawings.
4. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

1. Kinetic Noise Control, Inc. or approved equal.
2. Description: All-directional isolator with restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - a. Housing: Cast-ductile iron or welded steel.
 - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
3. Minimum deflection as indicated on Drawings.

2.5 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Kinetic Noise Control, Inc. or approved equal.
2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Damping Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel-to-steel contact.
4. Minimum deflection as indicated on Drawings.

2.6 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
 - 1. Kinetic Noise Control, Inc. or approved equal.
 - 2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at a rated load.
 - 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 6. Minimum deflection as indicated on Drawings.
 - 7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 8. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - 9. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 - 10. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.7 SNUBBERS

- A. Kinetic Noise Control, Inc. or approved equal.
- B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 - 1. Post-Installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors. Anchors to be prequalified in accordance with ACI 355.2 testing and designated in accordance with ACI 318-08 Appendix D for 2009 IBC/ACI 318-11 Appendix D for 2012 IBC/ACI 318-14 Ch. 17 for 2015 or 2018 IBC.
 - 2. Preset Concrete Inserts: Prequalified in accordance with ICC-ES AC446 testing.
 - 3. Anchors in Masonry: Design in accordance with TMS 402.
 - 4. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 - 5. Resilient Cushion: Maximum 1/4-inch (6-mm) air gap, and minimum 1/4 inch (6 mm) thick.

2.8 POST-INSTALLED CONCRETE ANCHORS

- A. Mechanical Anchor Bolts:
 - 1. Kinetic Noise Control, Inc. or approved equal.
 - 2. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.

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- B. Adhesive Anchor Bolts:
 - 1. Kinetic Noise Control, Inc. or approved equal.
 - 2. Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.
- C. Provide post-installed concrete anchors that have been prequalified for use in wind-load applications. Post-installed concrete anchors must comply with all requirements of ASCE/SEI 7-05, Ch. 13/ASCE/SEI 7-10, Ch. 13/ASCE/SEI 7-16, Ch. 13.
 - 1. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
 - 2. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.
- D. Expansion-type anchor bolts are not permitted for equipment more than 10 hp (7.46 kW) that is not vibration isolated.
 - 1. Undercut expansion anchors are permitted.

2.9 CONCRETE INSERTS

- A. Provide preset concrete inserts that are prequalified in accordance with ICC-ES AC466 testing.
- B. Comply with ANSI/MSS SP-58.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and wind-load control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to wind-load forces.

- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength is adequate to carry static and wind force loads within specified loading limits.

3.3 INSTALLATION OF VIBRATION AND WIND-LOAD CONTROL DEVICES

- A. Provide vibration and wind-load control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Device Schedules on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
- B. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- C. Installation of vibration isolators and wind-load restraints must not cause any change of position of equipment or ductwork resulting in stresses or misalignment.
- D. Equipment Restraints:
 - 1. Install snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 3. Install wind-load-restraint devices using methods approved by an evaluation service member of ICC-ES/OSHPD/an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Install wind-load-restraint devices using methods approved by an evaluation service member of ICC-ES/OSHPD/an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- I. Post-Installed Concrete Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineers if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduits, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

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3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 INSTALLATION OF AIR-SPRING ISOLATORS

A. Independent Isolator Installation:

1. Install automatic leveling valve into each air isolator.
2. Inflate each isolator to height and pressure specified on Drawings.

B. Pressure-Regulated Isolator Installation:

1. Connect all pressure regulators to a single dry, filtered facility/constant air supply.
2. Inflate isolators to height and or pressure specified on Drawings.

3.5 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT BASES

- A. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate dimensions of equipment base with requirements of isolated equipment specified in this and other Sections. Where dimensions of base are indicated on Drawings, they may require adjustment to accommodate isolated equipment.

3.6 ADJUSTING

- A. Adjust isolators after the 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.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections with the assistance of a factory-authorized service representative.

D. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least six (6) of each type and size of installed anchors and fasteners selected by Architect/Engineer of Record (EOR).
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. Test and adjust restrained-air-spring isolator controls and safety.

E. Remove and replace malfunctioning units and retest as specified above.

F. Prepare test and inspection reports.

END OF SECTION 230548.13

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Testing, Adjusting, and Balancing of Air Systems:
 - a. Variable-air-volume systems (VAV).
 - b. HVAC supply and return systems: Airside Economizer and Heat Recovery System.
 - c. Manual Volume Dampers (VD).
 - d. Modulating Outside Air Damper (min./max.) and CO2 interface
 - e. Diffusers and Grilles
2. Testing, adjusting, and balancing of HVAC equipment and systems.
3. Sound tests.
4. Vibration tests.
5. Duct leakage tests verification.
6. HVAC unit and VAV's control systems and cooling & heating systems verification.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. HVAC: Heating Ventilating, and Air-Conditioning Unit.

1.4 PREINSTALLATION MEETINGS

- A. TAB Conference: Conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan, to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

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1. Minimum Agenda Items:
 - a. The Contract Documents examination report.
 - b. Owner occupancy during the TAB procedures
 - c. The TAB plan.
 - d. Needs for coordination and cooperation of trades and subcontractors.
 - e. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 14 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 14 days of Contractor's Notice to Proceed, submit the Contract Documents review report, as specified in Part 3.
- C. Strategies and Procedures Plan: Within 14 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.
- D. System Readiness Checklists: Within 14 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 1. Instrument type and make.
 2. Serial number.
 3. Application.
 4. Dates of use.
 5. Valid Dates of calibration.

1.6 QUALITY ASSURANCE

- A. TAB Specialists Qualifications, Certified by NEBB or TABB:
 1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
 2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

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- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
- D. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

1.7 FIELD CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.
- F. Examine equipment performance data, including fan curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- J. Examine operating safety interlocks and controls on HVAC equipment.
- K. Examine control/volume dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.
- L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Ceilings are installed.
 - i. Walls, Roof, Windows and doors are installed.
 - j. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system in accordance with the procedures contained in ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, ducts and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.

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1. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 230713 "Duct Insulation,"
- C. Mark equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

- A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:
1. Motors.
 2. Supply Fan.
 3. Gas Furnace.
 4. Air-cooled condenser/compressor.
 5. Energy-recovery system/heat recovery wheel.
 6. VAV boxes.
 7. Outside air damper position (min. for 520 cfm/max. for 720 cfm)
 8. Coils.
 9. Filters.
 10. Exhaust/Relief fan.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross check the summation of required outlet volumes with the required fan volumes.
- B. Prepare schematic diagrams of systems' Record drawings duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air damper and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.

- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of the HVAC unit components.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
 - a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
 - b. Measure airflow and adjust calibration factors as required for design maximum airflow. Record calibration factor.
 - c. When the maximum airflow is correct, balance the air outlets downstream from terminal units.
 - d. Adjust controls so that terminal is calling for minimum airflow.
 - e. Measure airflow and adjust calibration factors as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
 - f. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.
5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturers.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow, so that connected total matches fan selection and simulates actual load in the building.
 - c. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
 - d. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
6. Measure fan static pressures as follows:

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- a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report any artificial loading of filters at the time static pressures are measured.
7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Balance the return-air ducts and inlets.
 - b. Verify that terminal units are meeting design airflow under system maximum flow.
8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set points and give controls Contractor.
9. Verify final system conditions as follows:
 - a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
 - b. Re-measure and confirm that total airflow is within design.
 - c. Re-measure final fan operating data, speed, volts, amps, and static profile.
 - d. Mark final settings.
 - e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
 - f. Verify tracking between supply and return fans.

3.7 PROCEDURES FOR MOTORS

- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Phase and hertz.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter size and thermal-protection-element rating.
 8. Service factor and frame size.
- B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.8 PROCEDURES FOR AIR-COOLED CONDENSERS

- A. Verify proper rotation of fan(s).
- B. Measure and record entering- and leaving-air temperatures.
- C. Measure and record entering and leaving refrigerant pressures.

- D. Measure and record operating data of fan(s) and motor(s).

3.9 SOUND TESTS

- A. After systems are balanced and Substantial Completion, measure and record sound levels at six (6) locations as designated by the Engineer/Architect.
- B. Instrumentation:
 - 1. The sound-testing meter shall be a portable, general-purpose testing meter consisting of a microphone, processing unit, and readout.
 - 2. The sound-testing meter shall be capable of showing fluctuations at minimum and maximum levels and measuring the equivalent continuous sound pressure level (L_{eq}).
 - 3. The sound-testing meter must be capable of using one-third octave band filters to measure mid-frequencies from 31.5 Hz to 8000 Hz.
 - 4. The accuracy of the sound-testing meter shall be plus or minus one decibel.
- C. Test Procedures:
 - 1. Perform test at quietest background noise period. Note cause of unpreventable sound that affects test outcome.
 - 2. The equipment should be operating at design values.
 - 3. Calibrate the sound-testing meter prior to taking measurements.
 - 4. Use a microphone suitable for the type of noise levels measured that is compatible with meter. Provide a windshield for outside or induct measurements.
 - 5. Record a set of background measurements in dBA and sound pressure levels in the eight unweighted octave bands 63 Hz to 8000 Hz (NC) with the equipment off.
 - 6. Take sound readings in dBA and sound pressure levels in the eight unweighted octave bands 63 Hz to 8000 Hz (NC) with the equipment operating.
 - 7. Take readings no closer than 36 inches (900 mm) from a wall or from the operating equipment and approximately 60 inches (1500 mm) from the floor, with the meter held or mounted on a tripod.
 - 8. For outdoor measurements, move sound-testing meter slowly and scan area that has the most exposure to noise source being tested. Use A-weighted scale for this type of reading.
- D. Reporting:
 - 1. Report shall record the following:
 - a. Location.
 - b. System tested.
 - c. dBA reading.
 - d. Sound pressure level in each octave band with equipment on and off.
 - 2. Plot sound pressure levels on Noise Criteria (NC) worksheet with equipment on and off.

3.10 VIBRATION TESTS

- A. After systems are balanced and Substantially Completion, measure and record vibration levels on equipment having motor horsepower equal to or greater than 2 hp.
- B. Instrumentation:
 - 1. Use portable, battery-operated, and microprocessor-controlled vibration meter with or without a built-in printer.
 - 2. The meter shall automatically identify engineering units, filter bandwidth, amplitude, and frequency scale values.
 - 3. The meter shall be able to measure machine vibration displacement in mils of deflection, velocity in inches per second, and acceleration in inches per second squared.
 - 4. Verify calibration date is current for vibration meter before taking readings.
- C. Test Procedures:
 - 1. To ensure accurate readings, verify that the accelerometer has a clean, flat surface and is mounted properly.
 - 2. With the unit running, set up a vibration meter in a safe, secure location. Connect the transducer to a meter with proper cables. Hold magnetic tip of transducer on top of the bearing and measure unit in mils of deflection. Record measurement, then move transducer to the side of the bearing and record in mils of deflection. Record an axial reading in mils of deflection by holding nonmagnetic, pointed transducer tip on end of shaft.
 - 3. Change vibration meter to velocity (inches per second) measurements. Repeat and record above measurements.
 - 4. Record CPM or rpm.
 - 5. Read each bearing (if applicable) on motor, fan as required. Track and record vibration levels from rotating components through casing to base.
- D. Reporting:
 - 1. The report shall record location, and the system tested.
 - 2. Include horizontal-vertical-axial measurements for tests.
 - 3. Verify that vibration limits follow Specifications, or, if not specified, follow the General Machinery Vibration Severity Chart or Vibration Acceleration General Severity Chart from AABC's "National Standards for Total System Balance." Acceptable levels of vibration are normally "smooth" to "good."
 - 4. Include in General Machinery Vibration Severity Chart, with conditions plotted.

3.11 DUCT LEAKAGE TESTS

- A. Witness the duct leakage testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified limits.
- C. Report deficiencies observed.

3.12 HVAC CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
 - 1. Verify HVAC control system is operating within the design limitations.
 - 2. Confirm that the sequences of operation are in compliance with Contract Documents.
 - 3. Verify that controllers are calibrated and function as intended.
 - 4. Verify that controller set points are as indicated.
 - 5. Verify the operation of lockout or interlock systems.
 - 6. Verify the operation of damper actuators.
 - 7. Verify that controlled devices are properly installed and connected to the correct controller.
 - 8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
 - 9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or CO₂.
- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.13 TOLERANCES

- A. Set HVAC system's airflow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent. If design value is less than 100 cfm (47 L/s), within 10 cfm (4.7 L/s).
 - 2. Air Outlets and Inlets: Plus or minus 10 percent. If design value is less than 100 cfm (47 L/s), within 10 cfm (4.7 L/s) for VAV box with two or more outlets.
 - 3. Air Outlets and Inlets: Plus or minus 5 percent. If design value is less than 100 cfm (47 L/s), within 5 cfm (2.4 L/s) for VAV box with one outlet.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.14 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.
- B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.15 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
 - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Fan curves.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. Other information related to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB specialist.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB supervisor who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents, including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.
 - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 - 15. Test conditions for fans performance forms, including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Heating coil, dry-bulb conditions.
 - e. Face and bypass damper settings at coils.
 - f. Fan drive settings, including settings and percentage of maximum pitch diameter.
 - g. Variable-frequency controller settings for variable-air-volume systems.
 - h. Settings for pressure controller(s).
 - i. Other system operating conditions affect performance.

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16. Test conditions for pump performance forms, including the following:
 - a. Variable-frequency controller settings for variable-flow hydronic systems.
 - b. Settings for pressure controller(s).
 - c. Other system operating conditions affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For HVAC unit, include the following:
 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches (mm), and bore.
 - i. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and speed.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factors.
 - e. Sheave make, size in inches (mm), and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm (L/s).
 - b. Total system static pressure in inches wg (Pa).
 - c. Fan speed.
 - d. Inlet and discharge static pressure in inches wg (Pa).
 - e. For each filter bank, filter static-pressure differential in inches wg (Pa).
 - f. Preheat-coil static-pressure differential in inches wg (Pa).
 - g. Cooling-coil static-pressure differential in inches wg (Pa).

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- h. Heating-coil static-pressure differential in inches wg (Pa).
- i. List for each internal component with pressure-drop, static-pressure differential in inches wg (Pa).
- j. Outdoor airflow in cfm (L/s).
- k. Return airflow in cfm (L/s).
- l. Outdoor-air damper position.
- m. Return-air damper position.
- n. [Vortex damper position].

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch (mm) o.c.
- f. Make and model number.
- g. Face area in sq. ft. (sq. m).
- h. Tube size in NPS (DN).
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm (L/s).
- b. Average face velocity in fpm (m/s).
- c. Air pressure drop in inches wg (Pa).
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
- e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
- f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
- g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
- h. Refrigerant expansion valve and refrigerant types.
- i. Refrigerant suction pressure in psig (kPa).
- j. Refrigerant suction temperature in deg F (deg C).

G. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Fuel type in input data.
- g. Output capacity in Btu/h (kW).
- h. Ignition type.
- i. Burner-control types.

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- j. Motor horsepower and speed.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.
 - m. Sheave make, size in inches (mm), and bore.
 - n. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
2. Test Data (Indicated and Actual Values):
- a. Total airflow rate in cfm (L/s).
 - b. Entering-air temperature in deg F (deg C).
 - c. Leaving-air temperature in deg F (deg C).
 - d. Air temperature differential in deg F (deg C).
 - e. Entering-air static pressure in inches wg (Pa).
 - f. Leaving-air static pressure in inches wg (Pa).
 - g. Air static-pressure differential in inches wg (Pa).
 - h. Low-fire fuel input in Btu/h (kW).
 - i. High-fire fuel input in Btu/h (kW).
 - j. Manifold pressure in psig (kPa).
 - k. High-temperature-limit setting in deg F (deg C).
 - l. Operating set point in Btu/h (kW).
 - m. Motor voltage at each connection.
 - n. Motor amperage for each phase.
 - o. Heating value of fuel in Btu/h (kW).
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches (mm), and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
 - 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and speed.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches (mm), and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
 - g. Number, make, and size of belts.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm (L/s).
 - b. Total system static pressure in inches wg (Pa).

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- c. Fan speed.
 - d. Discharge static pressure in inches wg (Pa).
 - e. Suction static pressure in inches wg (Pa).
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System fan and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F (deg C).
 - d. Duct static pressure in inches wg (Pa).
 - e. Duct size in inches (mm).
 - f. Duct area in sq. ft. (sq. m).
 - g. Indicated airflow rate in cfm (L/s).
 - h. Indicated velocity in fpm (m/s).
 - i. Actual airflow rate in cfm (L/s).
 - j. Actual average velocity in fpm (m/s).
 - k. Barometric pressure in psig (Pa).
- J. Air-Terminal-Device/VAV Boxes Reports:
 - 1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Apparatus used for tests.
 - d. Area served.
 - e. Make.
 - f. Number from system diagram.
 - g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft. (sq. m).
 - 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm (L/s).
 - b. Air velocity in fpm (m/s).
 - c. Preliminary airflow rate as needed in cfm (L/s).
 - d. Preliminary velocity as needed in fpm (m/s).
 - e. Final airflow rate in cfm (L/s).
 - f. Final velocity in fpm (m/s).
 - g. Space temperature in deg F (deg C).
- K. Instrument Calibration Reports:
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.

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- c. Application.
- d. Dates of use.
- e. Valid Dates of calibration.

3.16 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect or Construction Manager.
- B. The Architect or Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 25 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day for 2 days.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.
- E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
 - 2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.
- F. Prepare test and inspection reports.

3.17 ADDITIONAL TESTS

- A. Within 180 days of completing TAB, perform one (1) additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform up to two (2) additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 - 4. Outdoor, exposed supply and return.
- B. Related Requirements:
 - 1. Section 233113 "Metal Ducts" for duct liners.
 - 2. Section 233300 "Air Duct Accessories"

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or craft training program.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers are to be marked with the manufacturer's name, appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
 - 1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. All Insulation Installed Indoors; Outdoors-Installed Insulation in Contact with Airstream: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 3. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials are to be applied.
- B. Products do not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.
- F. Glass-Fiber Blanket: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 450 deg F (232 deg C) in accordance with ASTM C411. Comply with ASTM C553, Type II, and ASTM C1290, Type I, unfaced/Type II with factory-applied vinyl jacket/Type III with factory-applied FSK jacket/Type III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Glass-Fiber Board Insulation: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature between 35 deg F (1.7 deg C) and 250 deg F (121 deg C) for jacketed and between 35 deg F (1.7 deg C) and 450 deg F (232 deg C) for unfaced in accordance with ASTM C411. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation unfaced/with factory-applied ASJ/with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 ADHESIVES

- A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.4 MASTICS AND COATINGS

- A. Materials are compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic, Water Based, Interior Use: Suitable for indoor use on below ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).

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3. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database.
 4. Color: White.
- C. Vapor-Retarder Mastic, Solvent Based, Exterior Use: Suitable for outdoor use on below ambient services.
1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 2. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
 3. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm (0.66 metric perm) at manufacturer's recommended dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 3. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and are compatible with insulation materials, jackets, and substrates.
1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
 2. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
 3. Color: White.

2.6 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
1. Materials are compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 4. Color: Aluminum.

2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets comply with ASTM C921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. Metal Jacket:
1. Aluminum Jacket: Comply with ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing/Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.

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- c. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper/3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper/3-mil- (0.075-mm-) thick polysurlyn.
 - d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper/3-mil- (0.075-mm-) thick polysurlyn.
- 2. Stainless Steel Jacket: ASTM A240/A240M.
 - a. Sheet and roll stock ready for shop or field sizing/Factory cut and rolled to size.
 - b. Material, finish, and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper/3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper/3-mil- (0.075-mm-) thick polysurlyn.
 - d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper/3-mil- (0.075-mm-) thick polysurlyn.

2.8 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
 - 1. Width: 3 inches (75 mm).
 - 2. Thickness: 6.5 mils (0.16 mm).
 - 3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Width: 2 inches (50 mm).
 - 2. Thickness: 3.7 mils (0.093 mm).
 - 3. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
 - 4. Elongation: 5 percent.
 - 5. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.9 SECUREMENTS

- A. Bands:
 - 1. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm)/3/4 inch (19 mm) wide with wing seal or closed seal.
 - 2. Aluminum: ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm)/3/4 inch (19 mm) wide with wing seal or closed seal.
 - 3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:

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1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-)/0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-)/0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel/Aluminum/Stainless steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.
 - b. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel/Aluminum/Stainless steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel/aluminum/stainless steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

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7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
- D. Wire: 0.080-inch (2.0-mm) nickel-copper alloy/0.062-inch (1.6-mm) soft-annealed, stainless steel/0.062-inch (1.6-mm) soft-annealed, galvanized steel.

2.10 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum in accordance with ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.
- B. Stainless Steel Corner Angles: 0.024 inch (0.61 mm) thick, minimum 1 by 1 inch (25 by 25 mm), stainless steel in accordance with ASTM A240/A240M, Type 304 or Type 316.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

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- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Cut insulation in a manner to avoid compressing insulation.
- L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 - 4. Seal jacket to wall flashing with flashing sealant.

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- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.5 INSTALLATION OF GLASS-FIBER AND MINERAL-WOOL INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
- B. Comply with manufacturer's written installation instructions.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100/50 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
 - b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
 5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.

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6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.
- C. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100/50 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
 - b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

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6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches (300 mm) o.c. and at end joints.

3.7 FINISHES

- A. Insulation with Paintable Jacket Material: Paint jacket with paint system identified below.
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless steel jackets.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 1. Inspect ductwork, randomly selected by Architect and Engineer of Record (EOR), by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to three (3) location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

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- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
4. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation is one of the following:

1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.

B. Concealed, round and flat-oval, return-air duct insulation is one of the following:

1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.

C. Concealed, round and flat-oval, outdoor-air duct insulation is one of the following:

1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density

D. Concealed, round and flat-oval, exhaust-air duct insulation is one of the following:

1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.

E. Concealed, rectangular, supply-air duct insulation is one of the following:

1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.

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2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- F. Concealed, rectangular, return-air duct insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- G. Concealed, rectangular, outdoor-air duct insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- H. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- I. Concealed, supply-air plenum insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- J. Concealed, return-air plenum insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- K. Concealed, outdoor-air plenum insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.

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2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- L. Concealed, exhaust-air plenum insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- M. Exposed, round and flat-oval, supply-air duct insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- N. Exposed, round and flat-oval, return-air duct insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- O. Exposed, round and flat-oval, exhaust-air duct insulation is one of the following:
1. Flexible Elastomeric: 1 inch (25 mm) thick.
 2. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 3. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- P. Exposed, rectangular, supply-air duct insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- Q. Exposed, rectangular, exhaust-air duct insulation is one of the following:

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1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- R. Exposed, supply-air plenum insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- S. Exposed, return-air plenum insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.

3.11 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Exposed, round and flat-oval, supply-air duct insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- C. Exposed, round and flat-oval, return-air duct insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- D. Exposed, rectangular, supply-air duct insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.

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2. Glass-Fiber Board: 2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- E. Exposed, rectangular, return-air duct insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- F. Exposed, supply-air plenum insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.
- G. Exposed, return-air plenum insulation is one of the following:
1. Glass-Fiber Blanket: 1-1/2 inches (38 mm)/2 inches (50 mm)/3 inches (75 mm) thick and 0.75 lb/cu. ft. (12 kg/cu. m)/1.5 lb/cu. ft. (24 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m) nominal density.
 2. Glass-Fiber Board: 2 inches (50 mm)/3 inches (75 mm) thick and 2 lb/cu. ft. (32 kg/cu. m)/3 lb/cu. ft. (48 kg/cu. m)/6 lb/cu. ft. (96 kg/cu. m) nominal density.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Supply and Return/Exhaust Ducts and Plenums, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
1. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish: 0.016 inch (0.41 mm)/0.020 inch (0.51 mm)/0.024 inch (0.61 mm) thick.

END OF SECTION 230713

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Requirements:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 DEFINITIONS

- A. SMACNA: The Sheet Metal and Air Conditioning Contractor's National Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top and bottom of ducts.
5. Dimensions of main and all duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.

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11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: A single set of plans, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Welding certificates.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 3. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Airstream Surfaces: Surfaces in contact with airstream comply with requirements in ASHRAE 62.1.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- D. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
 2. For ducts exposed to weather, construct of Type 304/Type 316 stainless steel indicated by manufacturer to be suitable for outdoor installation.

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- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. For ducts with longest side less than 36 inches (914 mm), select joint types in accordance with Figure 2-1.
 - 2. For ducts with longest side 36 inches (914 mm) or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams are to be Pittsburgh lock seams unless otherwise specified for specific application.
 - 1. Where specified for specific applications, all joints are to be welded.
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
 - 2. For ducts exposed to weather, construct of Type 304/Type 316 stainless steel indicated by manufacturer to be suitable for outdoor installation.
- B. Source Limitations: Obtain single-wall round ducts and fittings from single manufacturer.
- C. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct

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construction methods unless otherwise indicated. Sheet metal materials are to be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G60 (Z180)/G90 (Z275).
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.
- D. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish is to be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.
- E. Aluminum Sheets: Comply with ASTM B209 (ASTM B209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. Factory- or Shop-Applied Antimicrobial Coating:
 - 1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating is to be applied to the exterior surface.
 - 2. Antimicrobial compound is to be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - 3. Coating containing the antimicrobial compound is to have a hardness of 2H, minimum, when tested in accordance with ASTM D3363.
 - 4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
 - 5. Shop-Applied Coating Color: Black/White.
 - 6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.
- G. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- H. Tie Rods: Galvanized steel, 1/4-inch- (6-mm-) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch- (10-mm-) minimum diameter for lengths longer than 36 inches (900 mm).

2.5 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Source Limitations: Obtain fibrous-glass duct liner from single manufacturer.
 - 2. Maximum Thermal Conductivity:

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- a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F (0.033 W/m x K) at 75 deg F (24 deg C) mean temperature.
3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound is to be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 4. Solvent/Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.
- B. Fibrous-Glass-Free, Natural-Fiber Duct Liner: Made from partially recycled cotton or polyester products and containing no fiberglass. Airstream surface overlaid with fire-resistant facing to prevent surface erosion by airstream, complying with NFPA 90A or NFPA 90B. Treat natural-fiber products with antimicrobial coating.
1. Source Limitations: Obtain fibrous-glass-free, natural-fiber duct liner from single manufacturer.
 2. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F (0.034 W/m x K) at 75 deg F (24 deg C) mean temperature when tested in accordance with ASTM C518.
 3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with ASTM E84; certified by an NRTL.
 4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
- C. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-)/0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel/aluminum/stainless steel; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) in diameter.
- D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s) or greater.

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7. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm (12.7 m/s) or where indicated.
9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch (2.4-mm) diameter, with an overall open area of 23 percent.
10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.6 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets are to be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: 3 inches (76 mm)/4 inches (102 mm)/6 inches (152 mm).
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: 10 inch wg (2500 Pa), positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
- C. Water-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.

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4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10 inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal is to provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and is to be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
- E. Steel Cables for Stainless Steel Ducts: Stainless steel complying with ASTM A492.
- F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2. Supports for Stainless Steel Ducts: Stainless steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- 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 (25 mm), plus allowance for insulation thickness.
- H. Route ducts to avoid passing through electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).
- J. Install air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- L. Elbows: Use long-radius elbows wherever they fit.
 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches (300 mm) and smaller and a minimum of five segments for 14 inches (350 mm) and larger.

- M. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR EXHAUST DUCTS SERVING HIGH-HUMIDITY LOCATIONS

- A. Install exhaust ducts from wet, high-humidity locations without dips and traps that may hold water. Slope ducts a minimum of 2 percent back to dishwasher or toward drain.
- B. Provide a drain pocket at each low point and at the base of each riser with a 1-inch (25-mm) trapped copper drain from each drain pocket to open site floor drain.
- C. Minimize number of transverse seams.
- D. Do not locate longitudinal seams on bottom of duct.

3.4 DUCTWORK EXPOSED TO WEATHER

- A. All external joints are to be welded. Seal all openings to provide weatherproof construction.
- B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.
- C. Single Wall:
 - 1. Ductwork is to be galvanized steel.
 - a. If duct outer surface is uninsulated, protect outer surface with suitable paint. Paint materials and application requirements are specified in Section 099113 "Exterior Painting."
 - 2. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 230713 "Duct Insulation."

3.5 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
 - 3. Outdoor/Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
 - 4. Outdoors: Return/Exhaust Ducts: Seal Class A.
 - 5. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 6. Conditioned Space, Return-Air Ducts: Seal Class B.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC."
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1220 mm) of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.7 DUCTWORK CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg (750 Pa): Test representative duct sections, selected by Architect/Engineer of Record from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
 - b. Supply Ducts with a Pressure Class of 3- (750) Inch wg (Pa) or Higher: Test representative duct sections, selected by Architect/Engineer of Record from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - c. Return Ducts with a Pressure Class of 3- (750) Inch wg (Pa) or Higher: Test representative duct sections, selected by Architect/Engineer of Record from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - d. Exhaust Ducts with a Pressure Class of 3- (750) Inch wg (Pa) or Higher: Test representative duct section, selected by Architect/Engineer of Record from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
 - 5. Test for leaks before applying external insulation.
 - 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

7. Give seven (7) days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media is to not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use duct cleaning methodology as indicated in NADCA ACR.

C. Use service openings for entry and inspection.

1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

D. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

E. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (grilles and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. HVAC unit internal surfaces and components including mixing box, coil section, spray eliminators, condensate drain pans, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.

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5. Return-air ducts, dampers, actuators, and turning vanes in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers and turning vanes.

F. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.11 STARTUP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.12 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

B. Supply Ducts:

1. Ducts Connected to VAV Boxes:
 - a. Pressure Class: Positive 2- (500) inch wg (Pa).
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
2. Ducts Connected to Variable-Air-Volume HVAC Units:
 - a. Pressure Class: Positive 4- (1000) inch wg (Pa).

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- b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 - 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 4- (1000) inch wg (Pa).
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- C. Return Ducts:
 - 1. Ducts Connected to HVAC Units:
 - a. Pressure Class: Positive or negative 3- (750)inch wg (Pa).
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 - 2. Ducts Connected to Equipment Not Listed above:
 - a. Pressure Class: Positive or negative 4- (1000) inch wg (Pa).
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- D. Return/Exhaust Ducts:
 - 1. Ducts Connected to HVAC Units:
 - a. Pressure Class: Positive or negative 3- (750) inch wg (Pa).
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 - 2. Ducts Connected to High-Humidity Locations:
 - a. Type 304, stainless steel sheet.
 - b. Exposed to View: No. 3-Satin finish.
 - c. Concealed: No. 2B-Matte finish.
 - d. Welded longitudinal seams; welded or flanged transverse joints with watertight EPDM gaskets.
 - e. Pressure Class: Positive or negative 3- (750)inch wg (Pa).
 - f. Airtight/watertight.
 - 3. Ducts Connected to Equipment Not Listed above:
 - a. Pressure Class: Positive or negative 4- (1000) inch wg (Pa).
 - b. Minimum SMACNA Seal Class: A if negative pressure; A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 6.

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d. SMACNA Leakage Class for Round and Flat Oval: 3.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel/Carbon steel coated with zinc-chromate primer/Galvanized steel or carbon steel coated with zinc-chromate primer.
2. Stainless Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Galvanized/Match duct material.
3. Aluminum Ducts: Aluminum.

F. Liner:

1. Supply-Air Ducts: Fibrous glass, Type I/Fibrous-glass-free, natural fiber, 1-1/2 (38)/2 (51) inch (mm) thick.
2. Return-Air Ducts: Fibrous glass, Type I/Fibrous-glass-free, natural fiber, 1-1/2 (38)/2 (51) inch (mm) thick.
3. Exhaust-Air Ducts: Fibrous glass, Type I/Fibrous-glass-free, natural fiber, 1 (25) inch (mm) thick.
4. Supply Fan Plenums: Fibrous glass, Type II/Fibrous-glass-free, natural fiber, 1-1/2 (38)/2 (51) inch (mm) thick.

G. Elbow Configuration:

1. Rectangular Duct - Requirements for Different Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm (5 m/s) or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm (7.6 m/s) or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

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- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 (305) Inches (mm) and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 (356) Inches (mm) and Larger in Diameter: Standing seam/Welded.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Conical spin in.
2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
 - c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Barometric relief dampers.
 - 2. Manual volume dampers.
 - 3. Flange connectors.
 - 4. Turning vanes.
 - 5. Duct-mounted access doors.
 - 6. Duct access panel assemblies.
 - 7. Flexible connectors.
 - 8. Duct accessory hardware.
- B. Related Requirements:
 - 1. Section 233713.23 "Diffusers and Grilles".

1.3 ACTION SUBMITTALS

- A. Shop Drawings: For duct accessories. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail duct accessories' fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Duct security bars.
 - f. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels required for access to duct accessories are shown and coordinated with each other, using input from installers of the items involved.
- B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 90A and NFPA 90B.
- B. 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.

2.2 BAROMETRIC RELIEF DAMPERS

- A. Greenheck or approved equal.
- B. General Requirements:
 - 1. Suitable for horizontal or vertical mounting.
 - 2. Maximum Air Velocity: 1000 fpm (5.1 m/s)/2000 fpm (10 m/s).
 - 3. Maximum System Pressure: 2 inches wg (0.5 kPa)/3 inches wg (0.8 kPa).
- C. Construction:
 - 1. Frame: Hat shaped, 16-gauge- (1.6-mm-) thick, galvanized sheet steel/0.093-inch- (2.4-mm-) thick extruded aluminum/18-gauge- (1.3-mm-) thick stainless steel, with welded corners or mechanically attached and mounting flange.
 - 2. Blades:

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- a. Multiple, 16-gauge- (1.6-mm-) thick, galvanized sheet steel/0.050-inch- (1.2-mm-) thick aluminum sheet/26-gauge (0.48-mm) Type 304 stainless steel.
 - b. Maximum Width: 6 inches (150 mm).
 - c. Action: Parallel.
 - d. Balance: Gravity.
 - e. Eccentrically/End pivoted.
- 3. Blade Seals: Vinyl/Neoprene.
 - 4. Blade Axles: Galvanized steel/Nonferrous metal/Plated steel/Stainless steel/Nonmetallic.
 - 5. Tie Bars and Brackets:
 - a. Material: Aluminum/Galvanized steel.
 - b. Rattle free with 90-degree stop.
 - 6. Bearings: Synthetic/Stainless steel.
- D. Pressure Adjustment: Return spring or counter weight with adjustable tension.
- E. Accessories:
- 1. Flange on intake.
 - 2. Adjustment device to permit setting for varying differential static pressures.

2.3 MANUAL VOLUME DAMPERS

A. Low-Leakage, Steel, Manual Volume Dampers:

- 1. Greenheck or approved equal.
- 2. Performance:
 - a. AMCA Certification: Test and rate in accordance with AMCA 511.
 - b. Leakage:
 - 1) Class IA: Leakage shall not exceed 3 cfm/sq. ft. (15.2 L/s per sq. m) against 1-inch wg (250-Pa) differential static pressure.
- 3. Construction:
 - a. Linkage: Out of airstream.
 - b. Suitable for horizontal or vertical airflow applications.
- 4. Frames:
 - a. Hat, U, or angle shaped.
 - b. Thickness: 16-gauge (1.6-mm) galvanized sheet steel/18-gauge (1.3-mm) stainless steel.
 - c. Mitered and welded corners.
 - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 5. Blades:

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- a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized/Stainless, roll-formed steel; 16 gauge (1.6 mm) thick.
 - 6. Blade Edging Seals:
 - a. Closed-cell neoprene.
 - b. Inflatable seal blade edging or replaceable rubber seals.
 - 7. Blade Jamb Seals: Flexible metal compression type/Vinyl/Neoprene.
 - 8. Blade Axles: Galvanized steel/Stainless steel/Nonferrous metal.
 - 9. Bearings:
 - a. Oil-impregnated bronze/Molded synthetic/Oil-impregnated stainless steel sleeve/Stainless steel sleeve.
 - b. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.
 - 10. Tie Bars and Brackets: Galvanized steel/Aluminum.
 - 11. Locking device to hold damper blades in a fixed position without vibration.
- B. Low-Leakage, Aluminum, Manual Volume Dampers:
- 1. Greenheck or approved equal.
 - 2. Performance:
 - a. AMCA Certification: Test and rate in accordance with AMCA 511.
 - b. Leakage:
 - 1) Class IA: Leakage shall not exceed 3 cfm/sq. ft. (15.2 L/s per sq. m) against 1-inch wg (250-Pa) differential static pressure.
 - 3. Construction:
 - a. Linkage out of airstream.
 - b. Suitable for horizontal or vertical airflow applications.
 - 4. Frames:
 - a. Hat, U, or angle shaped.
 - b. Thickness: 0.08-inch (2.0-mm) aluminum sheet channels.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Roll-Formed Aluminum Blades: 0.072-inch (1.8-mm-) thick aluminum sheet.
 - d. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.
 - 6. Blade Edging Seals:

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- a. Closed-cell neoprene.
 - b. Inflatable seal blade edging or replaceable rubber seals.
- 7. Blade Jamb Seals: Flexible metal compression type/Vinyl/Neoprene.
 - 8. Blade Axles: Galvanized steel/Stainless steel/Nonferrous metal.
 - 9. Bearings:
 - a. Oil-impregnated bronze/Molded synthetic/Oil-impregnated stainless steel sleeve/Stainless steel sleeve.
 - b. Dampers mounted with vertical blades to have thrust bearings at each end of every blade.
 - 10. Tie Bars and Brackets: Galvanized steel/Aluminum.
 - 11. Locking device to hold damper blades in a fixed position without vibration.

C. Jackshaft:

- 1. Size: 0.5-inch (13-mm)/1-inch (25-mm) diameter.
- 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
- 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

- 1. Zinc-plated, die-cast core with dial and handle, made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
- 2. Include center hole to suit damper operating-rod size.
- 3. Include elevated platform for insulated duct mounting.

2.4 FLANGE CONNECTORS

- A. Description: Add-on or roll-formed, factory fabricated, slide-on transverse flange connectors, gaskets, and components.
- B. Material: Galvanized steel.
- C. Gauge and Shape: Match connecting ductwork.

2.5 TURNING VANES (If applicable for low pressure system only)

- A. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

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- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- D. Vane Construction:
 - 1. Single wall for ducts up to 24 inches (600 mm) wide and double wall for larger dimensions.

2.6 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 7-2 (7-2M), "Duct Access Doors and Panels," and Figure 7-3, "Access Doors - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. 24-gauge- (0.70-mm-) thick galvanized steel or 0.032-inch (0.81-mm) thick aluminum or 24-gauge- (0.70-mm-) thick stainless steel door panel.
 - d. Vision panel.
 - e. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
 - f. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - a. 24-gauge- (0.70-mm-) thick galvanized steel or 0.032-inch- (0.81-mm-) thick aluminum frame.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches (460 mm) Square: Two hinges/Continuous and two sash locks.
 - c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges /Continuous and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Four hinges/Continuous and two compression latches with outside and inside handles.

2.7 DUCT ACCESS PANEL ASSEMBLIES

- A. Access panels used in cooking applications:
 - 1. Labeled in accordance with UL 1978 by an NRTL.
- B. Panel and Frame: Minimum thickness 16-gauge (1.6-mm) carbon/16-gauge (1.6-mm) stainless steel.

- C. Fasteners: Carbon/Stainless steel. Panel fasteners shall not penetrate duct wall.
- D. Gasket: Comply with NFPA 96, grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F (1093 deg C).
- E. Minimum Pressure Rating: 10 inches wg (2500 Pa) positive or negative.

2.8 FLEXIBLE CONNECTORS

- A. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Materials: Flame-retardant or noncombustible fabrics.
- D. Coatings and Adhesives: Comply with UL 181, Class 1.
- E. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm)/5-3/4 inches (146 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.
- F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
 - 2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
- G. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
 - 2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).
- H. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
 - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 - 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

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5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.9 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.10 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 1. Galvanized Coating Designation: G90 (Z275).
 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No. 2B-Matte finish for concealed ducts and No. 3-Satin finish for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B209 (ASTM B209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B221 (ASTM B221M), Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

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- C. Install backdraft (gravity)/control (motorized) dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.
- E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- F. Set dampers to fully open position before testing, adjusting, and balancing.
- G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters & filters housing.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. At each change in direction and at maximum 50-ft. (15-m) spacing.
 - 7. Upstream and downstream from turning vanes.
 - 8. Control devices requiring inspection.
 - 9. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Minimum Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 8 inches (200 by 200 mm).
 - 2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
 - 3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
 - 4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
 - 5. Body Access: 25 by 14 inches (635 by 355 mm).
 - 6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).
- K. Install flexible connectors to connect ducts to equipment.
- L. For fans developing static pressures of 3 inches wg (750 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- M. Install duct test holes where required for testing and balancing purposes.

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- N. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors, and verify that size and location of access doors are adequate to perform required operation.
3. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
4. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233713.23 - DIFFUSERS AND GRILLES

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. Adjustable blade face diffusers and grilles.
 - 2. Fixed face diffusers and grilles.

- B. Related Requirements:

- 1. Section 233300 "Air Duct Accessories" for volume-control dampers not integral to registers and grilles.
 - 2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

- 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including but not limited to the following: lighting fixtures, diffusers, grilles, speakers, sprinklers, WIFI devices, exit signs, and special moldings.
 - 5. Duct access panels.

- B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 DIFFUSERS

A. Adjustable Blade Face Diffuser:

1. Price, Greenheck or approved equal.
2. Material: Aluminum.
3. Finish: Baked-on powder coat finish, white/Baked enamel, color/finish selected & approved by Architect.
4. Face Blade Arrangement: Horizontal/Vertical spaced 1-1/2 inches (38 mm)/3/4 inch (19 mm)/1/2 inch (13 mm) apart.
5. Core Construction: Integral/Removable.
6. Rear-Blade Arrangement: Horizontal/Vertical spaced 3/4 inch (19 mm)/1/2 inch (13 mm) apart.
7. Frame: 1 inch (25 mm) wide.
8. Ceiling Type: See architectural drawings for ceiling type, dimension, mounting method.
9. Mounting: Countersunk screw/Concealed/Lay in.
10. Accessories:
 - a. Non-protrusive airflow directional tabs shall be provided on the back of the inner cones which may be positioned for either horizontal or vertical discharge.
 - b. The finish shall withstand a minimum salt spray exposure of 500 hours with no measurable creep in accordance with ASTM D1654, and 1000 hours of exposure with no rusting or blistering as per ASTM D610 and ASTM D714.
 - c. The inner cone assembly shall consist of 4 cones on 24x24 which drop below the ceiling plane.

2.2 GRILLES

A. Adjustable/Fixed Blade Face Grille for Return & Exhaust Air:

1. Price, Greenheck or approved equal.
2. Material: Aluminum.
3. Finish: Baked-on powder coat finish, white/Baked enamel, color/finish selected & approved by Architect.
4. Face Blade Arrangement: Horizontal/Vertical spaced 1-1/2 inches (38 mm)/3/4 inch (19 mm)/1/2 inch (13 mm) apart.
5. Core Construction: Integral/Removable.
6. Rear-Blade Arrangement: Horizontal/Vertical spaced 3/4 inch (19 mm)/1/2 inch (13 mm) apart.
7. Frame: 1 inch (25 mm) wide.
8. Ceiling Type: See architectural drawings for ceiling type, dimension, mounting method.
9. Mounting: Countersunk screw/Concealed/Lay in.
10. Accessories:
 - a. Front/Rear-blade gang operator.

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- b. The finish shall withstand a minimum salt spray exposure of 500 hours with no measurable creep in accordance with ASTM D1654, and 1000 hours of exposure with no rusting or blistering as per ASTM D610 and ASTM D714.

2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers and grilles level and plumb.
- B. Install diffusers and grilles per approved layout submittals/shop drawings.
- C. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- D. Install diffusers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 237416.11 - PACKAGED, SMALL-CAPACITY, HEATING VENTILATING AND AIR-CONDITIONING UNIT WITH GAS HEAT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Packaged, small-capacity, heating ventilating and air-conditioning unit (HVAC) with gas heat with the following components:
1. Unit casings.
 2. Fans, drives, and motors.
 3. Coils.
 4. Refrigerant circuit components.
 5. Air filtration (MERV 8 and MERV 13).
 6. Stainless Steel Gas furnace.
 7. Modulating Outside Air Damper.
 8. Barometric Relief Damper
 9. Heat Recovery Wheel.
 10. Hot Gas Reheat.
 11. VAV Controller
 12. VFD.
 13. Airside Economizer.
 14. Electrical power connections.
 15. Controls.
 16. Plenum/Curb with field cut for supply and return air duct connections.
 17. Accessories.

1.2 DEFINITIONS

- A. HVAC: Heating Ventilating and Air-Conditioning Unit. As used in this Section, this abbreviation means packaged, small-capacity, heating ventilating air-conditioning unit with gas heat.

1.3 ACTION SUBMITTALS

- A. Product Data: For each HVAC.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Include rated capacities, dimensions, required clearances, characteristics, and furnished specialties and accessories.
 3. Include unit dimensions and weight.
 4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
 5. Fans:

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- a. Include certified fan-performance curves with system operating conditions indicated.
 - b. Include certified fan-sound power ratings.
 - c. Include fan construction and accessories.
 - d. Include motor ratings, electrical characteristics, and motor accessories.
6. Include certified coil-performance ratings with system operating conditions indicated.
 7. Include filters with performance characteristics.
 8. Include gas furnaces with performance characteristics.
 9. Include dampers, including housings, linkages, and operators.
- B. Shop Drawings: For each packaged, small-capacity, heating ventilating and air-conditioning unit with gas heat (HVAC unit).
1. Include plans, elevations, sections, and plenum/curb mounting details and required wind restraints design.
 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, condensate piping, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and other details drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Sample Warranty: For manufacturer's warranty.
- C. Product Certificates: Submit certification that specified equipment will withstand wind forces identified on drawing number S802: Wind Design Data and Seismic Design Data.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Source quality-control reports.
- E. System startup reports.
- F. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For HVAC to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set of filters for each MERV rating: MERV-8 and MERV-13.
 - 2. Gaskets: One set for each access door.
 - 3. Fan Belts: One set for each belt-driven fan (if applicable).

1.7 WARRANTY

- A. Warranty: Manufacturer agrees to repair or replace components of packaged, small-capacity, rooftop air-conditioning unit that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Overall Unit-parts only for 12 months from date of equipment startup or 18 months from the date of original equipment shipment from the factory whichever is less.
 - 2. Warranty Period for Compressors and Energy Recovery Wheel: Manufacturer's standard, but not less than five (5) years from date of original equipment shipment from the factory.
 - 3. Warranty Period for Stainless Steel Heat Exchanger Furnace: Manufacturer's standard, but not less than twenty-five (25) years from date of original equipment shipment from the factory.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of HVACs and components.
- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE 15 Compliance: For refrigeration system safety.
- E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- F. UL Compliance: Comply with UL 1995 and UL 60335-2-40.
- G. Wind Design Data:
 - 1. Ultimate Design Wind Speed: 110 MPH (3 second gust).

2. Nominal Design Wind Speed: 85 MPH.
3. Risk Category: II.
4. Wind Exposure Category: B.
5. Internal Pressure Coefficient (GCPI): +0.18/-0.18

2.2 CAPACITIES AND CHARACTERISTICS

A. Supply-Air Fan:

1. Fan Type:
 - a. Direct drive, backward curved aluminum.
2. Airflow: 2,300 cfm.
3. External Static Pressure: 1.25 inches wg.
4. Fan Speed: Variable.
5. Motor Characteristics:
 - a. Horsepower: 2hp.
 - b. Motor Speed: Multispeed.
 - c. Volts: 208 V.
 - d. Phase: 3.
 - e. Hertz: 60.
 - f. Full-Load Amperes: 7.5 A.
 - g. Minimum Circuit Ampacity: 45 A (whole unit).
 - h. Maximum Overcurrent Protection: 60 A (whole unit).

B. Relief (Exhaust)-Air Fan:

1. Airflow: 2,300 cfm for airside economizer; 779 cfm for relief air for heat recovery wheel
2. External Static Pressure: 0.25 inches wg.
3. Fan Speed: Variable.
4. Motor Characteristics:
 - a. Horsepower: 1hp.
 - b. Motor Speed: Multispeed.
 - c. Volts: 208 V.
 - d. Phase: 3.
 - e. Hertz: 60.
 - f. Full-Load Amperes: 4.6 A.
 - g. Minimum Circuit Ampacity: 45 A (whole unit).
 - h. Maximum Overcurrent Protection: 60 A (whole unit).

C. Energy Recovery/Stainless Steel Rotary Heat Exchanger: Summer Conditions

1. Effectiveness: 78.8 percent.
2. Intake Airflow: 779 cfm.
3. Pressure Differential: 0.31 inches wg.
4. Entering Supply-Air Dry-Bulb Temperature: 89.0 deg F .
5. Entering Supply-Air Wet-Bulb Temperature: 73.0 deg F.
6. Leaving-Air Dry-Bulb Temperature: 77.3 deg F.

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7. Leaving-Air Wet-Bulb Temperature: 64.4 F.
8. Exhaust Airflow: 777 cfm.
9. Leaving Exhaust-Air Dry-Bulb Temperature: 86.5 deg F.
10. Leaving Exhaust-Air Wet-Bulb Temperature: 70.9 deg F.

D. Supply-Air Cooling Coil:

1. Total Net Cooling Capacity: 66.2 MBH.
2. Sensible Net Cooling Capacity: 49.6 MBH.
3. Entering-Air Dry-Bulb Temperature: 75.7 deg F.
4. Entering-Air Wet-Bulb Temperature: 62.8 deg F.
5. Leaving Air Dry-Bulb Temperature: 55.6 deg.F
6. Leaving Air Wet-Bulb Temperature: 52.5 deg.F.
7. Refrigerant Type: R-454B.

E. Outdoor-Air Refrigerant Coil:

1. Ambient-Air Temperature: 89.0/73.0deg F.
2. Coating: Baked phenolic.
3. Fan Motor: ECM.
4. Number of Fans: 1.
5. Refrigerant Type: R-454B.

F. Hot-Gas Reheat Coil:

1. Refrigerant Type: R-454B.
2. Capacity and Performance shall meet the ASHRAE 90.1 and 2020 NYSECCC.

G. Outside Air/Economizer:

1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq. ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring return enthalpy activated fully modulating actuator. Unit shall include outside air opening bird screen and outside air hood. Unit, except for horizontal series, shall also include barometric relief dampers.

H. Compressors:

1. Number of Refrigerant Circuits: One.
2. Compressor Speed: Variable Capacity Scroll Type.
3. Power Input: 208/3/60.
4. Energy-Efficiency Ratio (EER)@Op. Conditions: 12.6.
5. Cooling IEER: 14.8

I. Gas Furnace:

1. Airflow: 2,300 cfm.
2. Gas Control Valve: Modulating; Total turndown ratio: 10.0:1.

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3. Minimum Thermal Efficiency: 81.0 percent.
4. Input: 90.0 MBH .
5. Output: 72.9MBH max.
6. Entering-Air Temperature: 65.9/52.6 deg F.
7. Leaving-Air Temperature: 95.0/63.6 deg F.

J. Dampers:

1. Outdoor-Air (OA) Damper: Linked damper blades, for zero to 100 percent outdoor air, with motorized and modulating damper filter. OA damper's position shall be per sequence of operation and CO2 sensor interface.
2. Outdoor- and Return-Air Mixing Dampers: Opposed blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage or gears and interconnect so dampers operate simultaneously.
3. Relief-Air Damper: Barometric, as required by ASHRAE/IES 90.1.

K. The Unit/Recirculating-Air Filters:

1. Type: Pleated panel filters.
2. Depth: 2"+4" = 6 inches.
3. Access Location: Side, hinged access doors.
4. Maximum or Rated Face Velocity: 500 fpm
5. Initial Resistance: 0.1 inches wg.
6. Recommended Final Resistance: 0.5 inches wg.
7. Minimum Efficiency Reporting Value:
 - a. MERV Rating: MERV 8 and MERV 13, according to ASHRAE 52.2.

L. Heat Wheel/Outdoor-Air Filters:

1. Type: Pleated panel filters.
2. Depth: 2 inches.
3. Access Location: Side, hinged access doors.
4. Maximum or Rated Face Velocity: 500 fpm.
5. Initial Resistance: 0.1 inches wg.
6. Recommended Final Resistance: 0.5 inches wg .
7. Minimum Efficiency Reporting Value:
 - a. MERV Rating: MERV 8, according to ASHRAE 52.2.

M. Unit Electrical Characteristics for Single-Point Connection:

1. Voltage: 208 V.
2. Phase: 3.
3. Hertz: 60.
4. SCCR: 10 KAIC
5. Full-Load Amperes: 39A.
6. Minimum Circuit Ampacity: 45A.

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7. Maximum Overcurrent Protection: 60A.

N. Cabinet Sound Power Levels:

Discharge LW:

1. 1st Octave Band-63: 82 dB.
2. 2nd Octave Band-125: 82 dB.
3. 3rd Octave Band-250: 84 dB.
4. 4th Octave Band-500: 78 dB.
5. 5th Octave Band-1000: 72 dB.
6. 6th Octave Band-2000: 69 dB.
7. 7th Octave Band-4000: 65 dB.
8. 8th Octave Band-8000: 59 dB.

2.3 PACKAGED, SMALL-CAPACITY, HEATING VENTILATION, AND AIR-CONDITIONING UNIT WITH GAS HEAT.

A. AAON

B. TRANE

2.4 UNIT CASINGS

- A. General Fabrication Requirements for Casings, cabinet walls, access doors, and roof: Formed and reinforced double-wall, impact resistant, rigid polyurethane foam panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Double-Wall Construction:

1. Unit construction shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.
2. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel, and prevents exterior condensation on the panel.
3. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the mid point of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
4. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.

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5. Access to filters, dampers, cooling coils, reheat coil, heaters, energy recovery wheels, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
 6. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
 7. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
 8. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.
 9. Unit shall include lifting lugs on the top of the unit.
 10. Unit base pan shall be provided with 1/2 inch thick foam insulation.
- C. Airstream Surfaces: Surfaces in contact with airstream to comply with requirements in ASHRAE 62.1.
- D. Static-Pressure Classifications:
1. For Unit Sections Upstream of Fans: Minus 2-inch wg (500 Pa).
 2. For Unit Sections Downstream and Including Fans: 4-inch wg (1000 Pa).
- E. Panels and Doors:
1. Panels:
 - a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
 - b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement to allow panels to be opened against air-pressure differential.
 - c. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - d. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
 2. Access Doors:
 - a. Hinges: A minimum of two ball-bearing hinges or stainless steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
 - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
 3. Locations and Applications:
 - a. Fan Section: Doors.
 - b. Access Section: Doors.
 - c. Coil Section: Inspection and access panels.

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- d. Damper Section: Doors.
 - e. Filter Section: Doors large enough to allow periodic removal and installation of filters.
 - f. Mixing Section: Doors.
- F. Condensate Drain Pans:
- 1. Location: Cooling coils.
 - 2. Construction:
 - a. Single-wall, stainless steel 304 sheet.
 - 3. Drain Connection:
 - a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - b. Minimum Connection Size: NPS 1 (DN 25).
 - 4. Slope: Minimum 0.125-in./ft. (10-mm/mm) slope to comply with ASHRAE 62.1, in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) to direct water toward drain connection.
 - 5. Width: Entire width of water producing device.
 - 6. Depth: A minimum of 2 inches (50 mm) deep.
 - 7. Units with stacked coils must have an intermediate drain pan to collect condensate from top coil.

2.5 FANS, DRIVES, AND MOTORS

- A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
- B. Supply-Air Fans: Centrifugal, rated according to AMCA 210; galvanized or painted steel; mounted on solid-steel shaft.
 - 1. Shafts: With field-adjustable alignment.
 - a. Turned, ground, and polished hot-rolled steel with keyway.
 - 2. Shaft Bearings:
 - a. Heavy-duty, self-aligning, pillow-block type with an L-10 rated life of minimum 100,000 hours according to ABMA 9.
 - 3. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
 - a. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.

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4. Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; steel or aluminum hub swaged to backplate and fastened to shaft with setscrews.
 5. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard restrained vibration isolation mounting devices having a minimum static deflection of 1 inch (25 mm).
 6. Shaft Lubrication Lines: Extended to a location outside the casing.
 7. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches (89 mm) wide, attached to two strips of minimum 2-3/4-inch- (70-mm-) wide by 0.028-inch- (0.7-mm-) thick, galvanized-steel sheet.
 - a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives to comply with UL 181, Class 1.
- C. Drives, Direct: Factory-mounted, direct drive.
- D. Condenser-Coil Fan: Variable-speed propeller, mounted on shaft of permanently lubricated ECM motors.
- E. Exhaust/Relief-Air Fan: Backward curved aluminum, shaft mounted on permanently lubricated motor. Exhaust damper shall be sized for 100% relief. Fan and motor shall be dynamically balanced. Unit shall include barometric relief damper. Access to exhaust fan shall be through double wall, hinged access doors with quarter turn lockable handles.
- F. Motors:
1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Enclosure Type: Totally enclosed, fan cooled.
 4. Enclosure Materials: Cast iron.
 5. Motor Bearings: 100,000 hrs.
 6. Efficiency: Premium efficient as defined in NEMA MG 1.
 7. NEMA Design: 3R/4X.
 8. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
- 2.6 ENERGY RECOVERY/ROTARY HEAT EXCHANGER
- A. Heat exchanger integral with unit.
- B. Casing:
1. Stainless steel with manufacturer's standard factory-painted finish.
 2. Unit shall contain a factory mounted and tested energy recovery wheel. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive

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belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet.

3. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.
4. Units shall contain two 64 in. energy recovery wheels with a 2 in. minimum media thickness oriented in a "V" formation in the factory assembled cabinet.
5. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.
6. Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5 year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchangewritten instructions for Installation, Operation, and Maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.
7. Unit shall include 2 inch thick, pleated panel outside air filters with an ASHRAE MERV rating of 8, upstream of the wheels.
8. Hinged service access doors shall allow access to the wheel.
9. Unit shall include energy recovery wheel defrost control which includes an adjustable temperature sensor and timer wired to periodically stop the wheel rotation, which allows the warm exhaust air to defrost the wheel.

a. Polymer Energy Recovery Wheels

1. Shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.
2. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive.
3. Polymer Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5-year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. War-

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warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchange written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.

4. Total energy recovery wheels shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

2.7 COILS

A. General Requirements for Coils:

1. Comply with AHRI 410.
2. Fabricate coils section to allow for removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils to not act as structural component of unit.

B. Supply-Air Refrigerant/Evaporator Coil:

1. Evaporator Coils

- a. Coils shall be designed for use with R-454B refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
- b. Coil shall be standard capacity.
- c. Coils shall be hydrogen or helium leak tested.
- d. Coils shall be furnished with factory installed expansion valves.

2. Unit shall be factory charged with R-454B refrigerant.

3. Refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.

4. Unit shall be configured as an air-source heat pump. Each refrigeration circuit shall be equipped with a factory installed liquid line filter drier with check valve, reversing valve,

- a. Coils shall be designed for use with R-454B refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes.

1. Tubes: Copper.
2. Fins:

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- a. Material: Aluminum.
 - b. Fin Spacing: Maximum 12 fins per inch (mm).
- 3. Fin and Tube Joints: Mechanical bond.
- 4. Headers: Seamless-copper headers with brazed connections.
- 5. Frames: Galvanized steel.
- 6. Coatings: Corrosion-resistant coating.
- 7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.
- a. Working Pressure: Minimum 500 psig (3450 kPa).
- C. Outdoor-Air Refrigerant Coil:
 - 1. Tubes: Copper.
 - 2. Fins:
 - a. Material: Aluminum.
 - b. Fin Spacing: Maximum 12 fins per inch (mm).
 - 3. Fin and Tube Joints: Mechanical bond.
 - 4. Headers: Seamless-copper headers with brazed connections.
 - 5. Frames: Galvanized steel.
 - 6. Coating: Corrosion-resistant coating.
 - 7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.
 - a. Working Pressure: Minimum 500 psig (3450 kPa).
- D. Hot-Gas Reheat Refrigerant Coil:
 - 1. Tubes: Copper.
 - 2. Fins:
 - a. Material: Aluminum.
 - b. Fin Spacing: Maximum 12 fins per inch (mm).
 - 3. Fin and Tube Joints: Mechanical bond.
 - 4. Headers: Seamless-copper headers with brazed connections.
 - 5. Frames: Galvanized steel.
 - 6. Coatings: Corrosion-resistant coating.
 - 7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.
 - a. Working Pressure: Minimum 500 psig (3450 kPa).
 - 8. Suction-discharge bypass valve.

2.8 REFRIGERANT CIRCUIT COMPONENTS

- A. Compressor: Hermetic, variable-speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.
- B. Refrigeration Specialties:

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1. Refrigerant: R-454B.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.
10. Hot-gas reheat solenoid valve modulating with a replaceable magnetic coil.

2.9 AIR FILTRATION

A. Panel Filters:

1. Description: Flat, Pleated factory-fabricated, self-supported, disposable air filters with holding frames.
2. Filter Unit Class: UL 900.
3. Media: Interlaced glass, synthetic or cotton fibers coated with nonflammable adhesive and antimicrobial coating.
4. Filter-Media Frame: Beverage board with perforated metal retainer on outlet side.

- B. Adhesive, Sustainability Projects: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.

2.10 GAS FURNACES

- A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.
- B. CSA Approval: Designed and certified by and bearing label of CSA.
- C. Stainless steel heat exchanger furnace shall carry a 25 year non-prorated warranty, from the date of original equipment shipment from the factory.
- D. Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.
- E. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
- F. Unit shall include a single gas connection and have gas supply piping entrances in the unit base for through-the-curb gas piping and in the outside cabinet wall for across the roof gas piping.
- G. High Turndown Modulating Natural Gas Furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic

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controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls compartment. Gas heater shall be capable of capacity turndown ratio as shown on the unit rating sheet. Heat trace shall be include on the condensate drain

H. Burners: Stainless steel.

1. Rated Minimum Turndown Ratio: 10 to 1.
2. Fuel: Natural gas.
3. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
4. Gas Control Valve: Modulating.
5. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

I. Heat-Exchanger and Drain Pan: Stainless steel 304.

J. Venting, Gravity: Gravity vented.

K. Safety Controls:

1. Gas Manifold: Safety switches and controls complying with ANSI standards FM Global.

2.11 DAMPERS

A. Comply with requirements in Section 233300 "Air Duct Accessories"

B. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate must not exceed 4 cfm/sq. ft. (20 L/s per sq. m) at 1-inch wg (250 Pa) rated in accordance with AMCA 500D.

C. Barometric relief dampers.

D. Electronic Damper Operators:

1. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
2. Electronic damper position indicator to have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
3. Operator Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
 - c. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring

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mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
6. Size dampers for running torque calculated as follows:
 - a. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
 - b. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
 - c. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.
7. Coupling: V-bolt and V-shaped, toothed cradle.
8. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
9. Fail-Safe Operation: Mechanical, spring-return mechanism with external, manual gear release on nonspring-return actuators.
10. Power Requirements (Modulating): Maximum 10 VA at 24 V ac.
11. Proportional Signal: 2- to 10-V dc position feedback signal.
12. Temperature Rating: Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C).
13. Run Time: 12 seconds open, 5 seconds closed.

2.12 ELECTRICAL

- A. HVAC unit to have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.
- B. Unit shall have a 5kAIC SCCR.
- C. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
- D. Unit shall be provided with a factory installed and factory wired 115V, 12 amp GFI outlet disconnect switch in the unit control panel.
- E. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

2.13 CONTROLS

- A. Factory Installed and Factory Provided Controller
 - a. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of stand alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

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- b. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
 - c. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
 - d. Variable Air Volume Controller
 - 1. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.
 - e. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a BACnet network.
- A. Basic Unit Controls:
- 1. Control-voltage transformer.
 - 2. Wall-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. Exposed set point.
 - g. Exposed indication.
 - h. Degree F indication.
 - i. Unoccupied-period-override push button.
 - j. Data entry and access port to input temperature and humidity set points, occupied and unoccupied periods, and output room temperature and humidity, supply-air temperature, operating mode, and status.
 - 3. Wall-mounted CO2 sensor with the following features:
 - a. Concealed set point.
 - b. Exposed indication.
 - 4. Annunciator Panel for Each Unit:
 - a. Configuration: Unit mounted.
 - b. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
 - c. DDC controller or programmable timer and interface with HVAC instrumentation and control system.

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- d. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

B. Controller:

1. Type: DDC.
2. Controller to have volatile-memory backup.
3. Safety Control Operation:
 - a. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply-air temperature is less than 40 deg F (4 deg C).
 - b. Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
4. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
5. Unoccupied Period:
 - a. Heating Setback: 10 deg F (5.6 deg C).
 - b. Cooling Setback: System off.
 - c. Override Operation: one hour.
6. Supply Fan Operation:
 - a. Occupied Periods: Run fan continuously.
 - b. Unoccupied Periods: Cycle fan to maintain setback temperature.
7. Refrigerant Circuit Operation:
 - a. Occupied Periods: Cycle or stage compressors, and operate hot-gas bypass to match compressor output to cooling load to maintain room temperature and humidity. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
 - b. Unoccupied Periods: Cycle compressors and condenser fans for heating to maintain setback temperature.
 - c. Switch reversing valve for heating or cooling mode on air-to-air heat pump.
8. Hot-Gas Reheat-Coil Operation:
 - a. Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles the compressor.
 - b. Unoccupied Periods: Reheat not required.
9. Gas Furnace Operation:
 - a. Occupied Periods: Modulate burner to maintain discharge temperature.
 - b. Unoccupied Periods: Cycle burner to maintain setback temperature.
10. Modulating Outdoor-Air Damper Operation:
 - a. Occupied Periods: Open to preset position for 520 CFM min..

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- b. Unoccupied Periods: Close the outdoor-air damper.
- 11. Economizer Outdoor-Air Damper Operation:
 - a. Morning warm-up or cool-down cycles.
 - b. Occupied Periods: Open to predetermined position for a fixed minimum intake, and maximum 100 percent of the fan capacity. Controller is to permit air-side economizer operation when outdoor air is less than 55 deg F (13 deg C). Use outdoor-air temperature of 55 Deg. F and outdoor-air enthalpy to adjust mixing dampers. Start relief-air fan with end switch on outdoor-air damper. During economizer cycle operation, lock out cooling.
 - c. Unoccupied Periods: Close outdoor-air damper and open return-air damper.
- 12. Carbon Dioxide (CO2) Sensor interface with OA damper's position/operation:
 - a. Occupied Periods: Reset maximum outdoor-air damper's position to obtain 720 CFM to limit the maximum CO2 level to 700-ppm concentration.
 - b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.
- 13. Terminal-Unit Relays:
 - a. Provide heating- and cooling-mode changeover relays compatible with terminal control system required.
- C. Interface Requirements for HVAC Instrumentation and Control System:
 - 1. Interface relay for scheduled operation.
 - 2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
 - 3. Provide BACnet compatible interface for central HVAC control workstation for the following:
 - a. Adjusting set points.
 - b. Monitoring supply fan start, stop, and operation.
 - c. Inquiring data to include outdoor-air damper position, supply- and room-air temperature and humidity.
 - d. Monitoring occupied and unoccupied operations.
 - e. Monitoring variable motor loads.
 - f. Monitoring variable-frequency drive operation.
 - g. Monitoring cooling load.
 - h. Monitoring economizer cycles.
 - i. Monitoring air-distribution static pressure and ventilation air volume.

2.14 PLENUM/CURB

- A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
 - 1. Plenum/Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

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- a. Materials: ASTM C1071, Type I or II.
 - b. Thickness: 1 inch (25 mm).
- 2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - a. Liner Adhesive: Comply with ASTM C916, Type I.
 - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - c. Liner materials applied in this location to have airstream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
- B. Plenum/Curb Dimensions: Height of 22 inches (560 mm).

2.15 ACCESSORIES

- A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required.
- B. Low-ambient kit using variable-speed condenser fans for operation down to 35 deg F (1.7 deg C).
- C. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
- D. Remote potentiometer to adjust minimum economizer damper position.
- E. Return-air bypass damper.
- F. Factory- and field-installed, demand-controlled ventilation with CO₂ sensor interface with outside air damper's position.
- G. Safeties:
 - 1. Condensate overflow switch.
 - 2. Phase-loss reversal protection.
 - 3. High and low pressure control.
 - 4. Gas furnace airflow-proving switch.
- H. Coil guards of painted, galvanized-steel wire.
- I. Hail guards of galvanized steel, painted to match casing.
- J. Outdoor-air intake weather hood with moisture eliminator.
- K. Service Lights and Switch: Factory installed with weatherproof cover. Factory wire lights to a single-point field connection.

2.16 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209 (ASTM B209M).

E. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a 2,500-hour salt-spray test according to ASTM B117.

1. Standards:

- a. ASTM B117-95 for salt spray.
- b. ASTM D2794 for minimum impact resistance of 100 in-lb (11.3 N-m).
- c. ASTM B3359 for cross-hatch adhesion of 5B.

2. Application: Spray.

3. Thickness: 1 mil (0.025 mm).

4. Gloss: Minimum gloss of 60 on a 60-degree meter.

2.17 SOURCE QUALITY CONTROL

A. AHRI Compliance:

1. Comply with AHRI 210/240 for testing and rating energy efficiencies for HVACs.
2. Comply with AHRI 340/360 for testing and rating energy efficiencies for HVACs.
3. Comply with AHRI 270 for testing and rating sound performance for HVACs.
4. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.

B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested according to AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of HVAC unit.
- B. Examine roughing-in for HVAC unit to verify actual locations of piping and duct connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Unit Support: Install unit level on structural plenum/curb by the unit manufacturer. Coordinate wall penetrations and flashing with wall construction. Secure the HVAC unit to structural support with anchor bolts.
 - 1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

3.3 PIPING CONNECTIONS

- A. Connect condensate drain pans using NPS 1 (DN 25), ASTM B88, Type M copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- B. Gas Piping: Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

3.4 DUCT CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to terminate on the side of the plenum/curb.
 - 2. Install supply air duct to the HVAC unit's plenum/curb with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
 - 3. Install return-air duct horizontally through the side of the plenum/curb with the flexible connection.

3.5 ELECTRICAL CONNECTIONS

- A. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

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- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate is to be laminated acrylic or melamine plastic signs as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate is to be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inch (13 mm) high.
 - 3. Locate nameplate where easily visible.

3.6 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring associated with HVAC equipment.

3.7 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Inspect for visible damage to unit casing.
 - 3. Inspect for visible damage to furnace combustion chamber.
 - 4. Inspect for visible damage to compressor, coils, and fans.
 - 5. Inspect internal insulation.
 - 6. Verify that labels are clearly visible.
 - 7. Verify that clearances have been provided for servicing.
 - 8. Verify that controls are connected and operable.
 - 9. Verify that filters are installed.
 - 10. Clean condenser coil and inspect for construction debris.
 - 11. Clean furnace flue and inspect for construction debris.
 - 12. Connect and purge gas line.
 - 13. Remove packing from vibration isolators.
 - 14. Inspect operation of barometric relief dampers.
 - 15. Verify lubrication on fan and motor bearings.
 - 16. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - 17. Adjust fan belts to proper alignment and tension.
 - 18. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.

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19. Inspect and record performance of interlocks and protective devices; verify sequences.
20. Operate unit for an initial period as recommended or required by manufacturer.
21. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency:
 - a. Measure gas pressure on manifold.
 - b. Inspect operation of power vents.
 - c. Measure combustion-air temperature at inlet to combustion chamber.
 - d. Measure flue-gas temperature at furnace discharge.
 - e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
22. Calibrate thermostats.
23. Adjust and inspect high-temperature limits.
24. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
25. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F (8 deg C) above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
26. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
27. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.
28. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
29. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - a. High-temperature limit on gas-fired heat exchanger.
 - b. Low-temperature safety operation.
 - c. Filter high-pressure differential alarm.
 - d. Economizer to minimum outdoor-air changeover.
 - e. Relief-air fan operation.
 - f. Smoke and firestat alarms.

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30. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.8 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.
- C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two (2) visits to Project during other-than-normal occupancy hours for this purpose. The two site visits shall be up to 4 hours for each visit during normal and after business hours.

3.9 CLEANING

- A. After completing system installation and testing, adjusting, and balancing the HVAC unit and air-distribution systems, clean HVAC unit internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections with the assistance of a factory-authorized service representative.
- D. Tests and Inspections:
 1. After installing HVAC unit and after electrical circuitry has been energized, test unit for compliance with requirements.
 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. HVAC unit will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the HVAC unit.

END OF SECTION 237416.11

ITEM 627.0026 25**ELECTRICAL****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.
- 1.02 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0026 25**ELECTRICAL****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

A.	Section 260100	GENERAL ELECTRICAL REQUIREMENTS
B.	Section 260519	LOW-VOLTAGE CONDUCTORS AND CABLES
C.	Section 260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
D.	Section 260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
E.	Section 260533	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
F.	Section 260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
G.	Section 262416	PANELBOARDS
H.	Section 262726	WIRING DEVICES
I.	Section 262816	ENCLOSED SWITCHES
J.	Section 265100	LIGHTING

1.02 This item shall include, but not be limited to, the following:

A.	Lighting and control devices for the building's addition
B.	Raceways, boxes, and other electrical components needed for the building's addition

SECTION 260100 – GENERAL ELECTRICAL REQUIREMENTS**PART 1 - GENERAL****1.1 SUMMARY**

- A. The General Conditions, Supplementary General Conditions, Instructions to Bidders, General Requirements, and Division 1 of these Specifications are part of the work of this Section.
- B. Section 260100 General Electrical Requirements applies to the work of each Electrical Specification Section.

1.2 EQUIPMENT AND MATERIALS SPECIFIED

- A. Where products are named in the Electrical specifications, the first named product is the Architect's basis for design. Other product manufacturers named in the specifications are acceptable; however, the Contractor must first confirm that these products fit into the available space, and meet all performance requirements indicated on the Contract Documents, prior to submitting them for approval. Where products do not fit into available space or do not meet all performance requirements, the product is not acceptable.
- B. Where the Contractor submits for approval equipment or materials other than those that are the Architect's basis for design, the Contractor shall first demonstrate in writing that the equipment or materials will fit into available space, and will meet or exceed all performance requirements indicated on the drawings. Where, in the opinion of the Architect, any characteristic of the product or material requires that modifications be made to this or any other Contract of this project, the cost of all such modifications to this and other Contracts shall be borne by the Contractor offering the substitution.

1.3 ABSENCE OF SPECIFICATION

- A. Where the drawings or the specifications do not name a particular brand or manufacturer of any item, these items are still part of the Work. This Contractor shall provide all such items that may be fairly and reasonably judged throughout the construction industry to be the most appropriate and best quality item for the intended application. Provide submittals for proposed items to the Architect for review and approval.

1.4 SCOPE OF WORK

- A. Refer to Section 01010, Division of Work for description of the work to be performed under this Contract.

1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings are diagrammatic, and have been developed by the Architect for the purpose of indicating the sizes, capacities, and the general arrangement of the systems to be installed under this Contract. Install all equipment in complete compliance with manufacturer's instructions, applicable codes and ordinances, and in a neat and workmanlike manner. Field inspect all existing conditions, and identify any obstacles or interferences which may affect the execution of the work. Carefully lay out the routing and location of all equipment and materials so as to accommodate obstacles and interferences, and to provide proper maintenance and access clearances. Notify the Architect of any conflicts that will affect the quality, performance, or appearance of the systems installed under this Contract, prior to installing them.
- B. Refer to the Architectural Plans for dimensioned drawings. Do not determine dimensions by scaling the Drawings.

1.6 CODES AND STANDARDS

- A. Install all work in complete compliance with the applicable provisions of the following:
 - 1. Building Code of New York State
 - 2. Energy Conservation Construction Code of New York State
 - 3. National Electrical Code, NFPA 70
 - 4. National Fire Alarm Code, NFPA 72
 - 5. Underwriter's Laboratories
 - 6. National Fire Protection Association Standards
 - 7. Utility Company Standards and Requirements
 - 8. Occupational, Safety and Health Act (OSHA)
- B. All electrical equipment and materials shall be U.L. (Underwriter's Laboratories) listed.
- C. Requirements of other agencies apply to the work of the Contract, including IEEE, ANSI, NEMA, ASTM, and are referenced in specific specification sections.

1.7 SUBMITTALS, SHOP DRAWINGS, WIRING DIAGRAMS

- A. Unless otherwise waived, provide submittals for all equipment and materials that are part of this Contract.
- B. Submittals shall include dimensions, weights, capacities, and a list of all specific features and accessories that are to be provided for this project, and in sufficient detail to permit the Architect to determine compliance with specified requirements.
- C. Provide shop drawings for approval by the Architect of all fabricated systems and materials, including, but not limited to:
 - 1. Fire Alarm System
- D. Refer to Division 1 for additional requirements for submittals and shop drawings. Where such requirements conflict with this section, the more stringent shall apply.

1.8 LAYOUT, COORDINATION AND SEQUENCING**A. GENERAL**

1. Coordinate the work with the work of other contractors working on this project.
2. It is the responsibility of this Contractor to lay out and adjust the location of the work of this Contract. Contractor's layout shall accommodate all obstacles and interferences anticipated or encountered. Contractor shall relocate obstacles and interferences where required, and as may additionally be directed by the Architect.
3. Install the work sequentially with respect to the work of other trades, and as directed by the Construction Manager or General Contractor in a timely manner, and so as not to delay the work of other trades or of the Project schedule.
4. Adhere to the established Construction Schedule for the Project.
5. Order all equipment and materials in a timely manner so as not to delay the Project. Notify the Architect of any delays in the timely procurement of equipment and materials.

1.9 RECORD DRAWINGS

- A. This Contractor shall prepare record drawings of the completed work of this Contract.
- B. Refer to Division 1 for requirements for the preparation and submission of Record Drawings.

1.10 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Operation instruction: after all systems have been completely installed and satisfactorily tested, instruct the Owner's representative on the operation of all systems and equipment that are part of this Contract. Instruction shall be a "hands on" session, whereby the Contractor physically demonstrates the proper operation of all items of equipment. Provide written instructions for the Owner's use prior to the time of instruction, and amend same where required. Include sufficient time to permit the Owner to master the operation of all systems.
- B. Provide six (6) bound sets of maintenance manuals covering all systems installed under this contract. Manuals shall adhere to the following requirements:
 1. Bound in three-ring binders.
 2. Cover sheet to include Project title, Contractors name, contact person, contact information, name and contact information of all factory equipment representatives.
 3. Table of contents; tabulated section for each major system.
 4. Operations instructions for each major system.
 5. Include the following for each item of equipment furnished under this contract:
 - a. Maintenance instructions
 - b. Manufacturer's data sheets
 - c. Recommended spare parts inventory
 - d. Wiring diagrams
 6. Preventative maintenance schedule
 7. Record drawings

1.11 REMOVALS AND DEMOLITION

- A. Where drawings indicate items to be removed, Contractor shall remove all existing light fixtures, outlets, switches, controls, panelboards, disconnects, conduit, wiring, cable, hangers, accessories in areas of the existing building that are being renovated or altered, and in areas where equipment and or devices will no longer be used. Disconnect all circuits at source that are abandoned. Where conduit cannot be removed, such as conduit embedded in concrete slabs, remove all wiring and cable from conduits. Where indicated, carefully remove existing equipment, lighting fixtures and other devices, and store for re-installation. Where outlet and back boxes are abandoned and the wiring removed and/or permanently disconnected, the outlet and back boxes are to be patched to match the existing wall or ceiling finish.
- B. Remove items from the site that are not indicated to be saved, and dispose of at an approved disposal facility. Pay all fees associated with disposal of removed items.
- C. Contractor to exercise extreme care to preserve materials, finishes, and equipment to remain. Contractor shall repair all damage incurred to the existing premises, materials, finishes and equipment.
- D. Where the Contract Documents require that equipment be turned over to the Owner, Contractor to exercise extreme care in removing and handling the equipment, and shall turn same over to owner in same condition as presently exists, and at location as directed by the Owner.

1.12 ROUGHING IN

- A. Rough in all equipment, fixtures, switchboards, panels, boxes, conduit prior to the installation of covering wall, ceiling and floor finishes.
- B. Arrange for all required inspections and testing of concealed work prior to installation of covering wall, ceiling and floor finishes.
- C. Where work is to be installed in existing wall and ceiling cavities, carefully cut open walls, ceilings, floors, taking care to preserve the structural integrity of same. Provide new lintels and other structural supports and reinforcement. Install and secure new work with these cavities, and restore ceiling, wall and floor assemblies and finishes to match existing.
- D. Where work is to be installed in new chases, coordinate location of all openings and install new work plumb and perpendicular.

1.13 CUTTING AND PATCHING

- A. Provide cutting and patching for all work under this Contract.
- B. Provide steel lintels for all duct floor and wall penetrations and similar large openings.
- C. Provide steel sleeves for all conduit floor and wall penetrations.
- D. Refer to Division 1, Section "Cutting and Patching" for additional requirements.

1.14 CONCEALMENT

- A. Conceal all raceways, wiring, and cables above ceilings and within walls, below slabs, and elsewhere through the building, except in unfinished spaces. Where a conflict exists that renders concealment impossible, notify the Architect before starting the work and install as directed.

1.15 FIRE-STOPPING

- A. Refer to Division 7, Section Firestopping. Where the provisions contained in Division 7 Section Firestopping conflict with the requirements contained herein, the more stringent shall apply.
- B. Where Division 7 Section Firestopping is not included, the provisions contained herein shall apply.
- C. Provide materials and products listed by an independent testing laboratory for Through-Penetration Fire Stop Systems, to meet requirements of Fire Tests of Through Penetrations Fire-Stops, ASTM E814.
- D. Provide fire stop system at all locations where piping, tubing, conduit, cables, ductwork, and similar items pass through or penetrate any fire rated wall or floor assembly. Where fire ratings of wall and floor assemblies are not indicated on the drawings, Contractor is to assume that all floor and wall assemblies are two (2) hour fire rated assemblies.

1.16 ACCESS DOORS AND PANELS

- A. Refer to Division 8, Section "Access Panels"; where the provisions contained in that section conflict with the requirements contained herein, the more stringent shall apply. Where Division 8 Section "Access Panels" is not included, the provisions contained herein shall apply.
- B. Provide access doors for all recessed junction boxes, controls, and for all other items of equipment that require access.
- C. Access doors used shall be specifically designed for the material composing the wall or ceiling where installed.
- D. Unless otherwise indicated, access doors shall be prime painted steel, minimum 14 gauge frame and panel, except where used in toilet rooms, kitchens and showers, where they shall be 16 gauge frame and panel stainless steel. Unless otherwise indicated, hinges shall be piano hinge style.
- E. Access doors used in fire rated walls, partitions and ceilings shall be Underwriters Laboratories 1-1/2 hour class B fire rated.
- F. Locks shall be screwdriver type, unless otherwise indicated.
- G. Access doors shall be securely attached to the wall, ceiling, or framing material, and installed in complete conformance to manufacturer's installation instructions.
- H. The contractor shall coordinate the location of all access doors to permit unrestricted access to the equipment to be accessed. Where multiple items of equipment in the same vicinity can be grouped together, provide access panels of proper size to permit unrestricted access to all such

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items. The Contractor shall incorporate access panel locations into the preparation of Coordination Drawings, and shall adjust specific quantities and locations of access panels to permit access all items of equipment which require access.

- I. Access doors as manufactured by Milcor, or approved equivalent.

1.17 EQUIPMENT INSTALLATION

- A. Install all equipment in compliance with manufacturer's instructions and the Contract Documents. Notify the Architect where manufacturer's instructions differ from the Contract Documents for resolution.
- B. Lay out equipment to provide access to all components requiring maintenance. Provide clearances as required by applicable codes and standards, as well as manufacturer's recommendations, and good practice.
- C. Lay out equipment so as to provide adequate removal clearance for coils, tubes, fan assemblies, and similar components.
- D. Equipment shall be plumb and level, and secured to supporting structures as specified, recommended by manufacturer, and as dictated by good practice.

1.18 EQUIPMENT SUPPORTS, ROOF CURBS AND CONCRETE BASES

- A. Provide supporting structures for all mechanical equipment.
- B. Concrete Bases:
 - 1. Provide concrete bases for all floor mounted equipment including, but not limited to, switchboards, motor control centers, generators, transfer switches, and all other similar free standing electrical equipment.
 - 2. Floor mounted electrical equipment shall be mounted on 6" high concrete bases. The plan dimensions of each base shall extend 6" beyond the outer extents of the equipment served.
 - 3. Concrete bases shall be reinforced with welded wirefabric and consist of minimum 4000 psi strength concrete. Concrete bases shall be steel reinforced, and shall be smooth and level.
 - 4. Corners of concrete bases shall be chamfered.
 - 5. Paint edge of bases two coats bright yellow.
- C. Equipment support frames:
 - 1. Provide steel support frames for all equipment under this Contract that is to be installed on walls, or on floor standing frames including: panelboards, motor starters, disconnect switches, transfer switches, control panels, current transformer cabinets, meter channels, and similar equipment.
 - 2. Use galvanized structural steel channels and steel angles, bolted construction.
 - 3. Provide ¼" steel plate at each vertical floor support, anchor bolted to floor; anchor top of each vertical support to structure above.
 - 4. Provide diagonal bracing to restrain deflection in the three perpendicular axes.

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5. Attach equipment to frame using approved fasteners and vibration isolating mounting hardware.
6. For transformers and similar suspended equipment, use horizontal frames of steel angle or channels, suspended from above from four points with threaded rods, forged steel turnbuckles and associated hardware for suspended items such as transformers, and similar equipment as approved by the Architect. Provide lateral sway bracing anchored to structure for each orthogonal axis. Use steel angles or channels for this purpose.
 - a. Threaded rod schedule, total weight suspended based on minimum four (4) rods:

	Weight	Rod Diameter (4 rods required to support Weight)
1)	0-300 lbs.	3/8"
2)	301-585 lbs.	1/2"
3)	586-900 lbs.	5/8"
4)	901-1350 lbs.	3/4"
5)	1351-2500 lbs.	1"
6)	1/4" dia. rod is not permitted	

1.19 ROOF PENETRATIONS

- A. Provide pre-fabricated roof penetration curbs for all conduit roof penetrations.
- B. Coordinate installation with roofing contractor.
- C. Curbs by Pate Company, or approved equivalent.

1.20 START-UP AND TESTING

- A. Engage the services of a qualified factory representative for all manufactured equipment to assist in the start-up of all systems and equipment installed under this Contract.
- B. Test all systems, equipment, components, and controls installed under this Contract.
- C. Test all related accessories installed under this Contract.
- D. Testing requirements are contained in Division 16 specifications for each specific equipment, component, and material type.
- E. Correct all deficient items detected and re-test until results are satisfactory.
- F. Upon completion of testing, submit a comprehensive written test report to the Architect for review and approval.

1.21 EXISTING CONDITIONS

- A. Inspect the existing premises where the work is performed prior to submitting a proposal to perform the work. Note all instances where interferences and/or obstacles will affect the layout of the work.

1.22 IDENTIFICATION

- A. Identify all equipment, fixtures, panels, starters, disconnects, wiring devices, and controls with permanent, marking system as specified.
- B. Identify junction boxes and conduit serving emergency systems.
- C. Refer to Section “Electrical Identification” for requirements.

1.23 PAINTING

- A. All painting shall consist of one prime and two finish color coats of non-lead oil base paint, unless otherwise indicated. Provide heat resistant paint where temperatures exceed 200 deg F. Provide Pittsburgh Paint Co. “Galvanized Iron Primer” for all galvanized surfaces. Clean all surfaces to be painted thoroughly before painting. Paint color for piping shall conform to Owner’s requirements. Paint shall be as manufactured by Sherwin Williams, Pratt and Lambert, or approved equivalent.
- B. Touch up all factory painted equipment where surface has been scratched or where paint finish is otherwise damaged.
- C. Paint all junction boxes serving emergency systems.

1.24 CLEANING

- A. Keep the job site and premises clean at all times. Refer to Division 1 for requirements.
- B. Contractor shall maintain all installed work clean throughout the duration of the project.
 - 1. Remove debris, dirt, grease, paint, plaster, etc. from all equipment and materials installed.
 - 2. Restore original finish of any equipment and materials damaged during construction.
- C. Clean all lighting fixtures, lamps, and lenses at the completion of the work.

1.25 LICENSING

- A. Contractor shall maintain all required licenses to perform the work of his respective trade in the locality where the project is constructed.
- B. All electrical work shall be performed under the supervision of a licensed electrician.

1.26 PERMITS

- A. Apply for all required permits associated with the work of this Contract and pay the cost of all associated permitting fees.
- B. Electrical Inspection: Arrange to have the completed electrical installation inspected by an approved Electrical Inspector; pay all fees.

1.27 UTILITIES

- A. This Contractor shall file all applications for all utility services for this project with the respective utility companies, authorities, and all other related agencies, and on a timely basis, so as not to delay the project. The Contractor shall assemble all required information, data, drawings that are required by the utility company. The Architect will provide copies of those Contract Documents requested by the utility.

1.28 BALANCING

- A. Balance loads on all panelboards by re-arranging circuits on phases or legs as required to achieve load balance within 5% among phases.

1.29 GROUNDING

- A. Ground all equipment, devices, raceways per National Electrical Code.
- B. Refer to Specification Section Grounding for requirements.

1.30 STORAGE AND PROTECTION OF MATERIALS

- A. Refer to Division 1.

1.31 TEMPORARY HEAT

- A. Refer to Division 1.

1.32 TEMPORARY LIGHT AND POWER

- A. Provide temporary lighting throughout entire duration of construction.
- B. Provide temporary power throughout entire duration of construction. Coordinate temporary power needs with other contractors.
- C. Refer to Division 1 for additional requirements.

PART 2 - PRODUCTS – not used

PART 3 - EXECUTION – not used

END OF SECTION 260100

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Sections include the following:
 - 1. Division 27 Section "Communications Cabling" for cabling used for voice and data circuits.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 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 NFPA 70.

PART 2 - PRODUCTS**2.1 CONDUCTORS AND CABLES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Alcan Products Corporation; Alcan Cable Division.
 2. American Insulated Wire Corp.; a Leviton Company.
 3. General Cable Corporation.
 4. Senator Wire & Cable Company.
 5. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.
- D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
 2. Hubbell Power Systems, Inc.
 3. O-Z/Gedney; EGS Electrical Group LLC.
 4. 3M; Electrical Products Division.
 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION**3.1 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- D. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- G. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- H. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- I. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

- A. 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.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- C. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

- A. Section Includes: Grounding systems and equipment.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
- 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches (600 mm) below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

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- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
 8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- G. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install [tinned] bonding jumper to bond across flexible duct connections to achieve continuity.
- D. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

3.4 LABELING

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
 - 1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

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- b. Perform tests by fall-of-potential method according to IEEE 81.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 - 1. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.

- B. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 4. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

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- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with [two-bolt conduit clamps] [single-bolt conduit clamps] [single-bolt conduit clamps using spring friction action for retention in support channel].
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

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6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 7. To Light Steel: Sheet metal screws.
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Boxes, enclosures, and cabinets.
 - 5. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS**2.1 METAL CONDUITS, TUBING, AND FITTINGS**

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 3. Anamet Electrical, Inc.

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4. Electri-Flex Company.
 5. O-Z/Gedney; a brand of EGS Electrical Group.
 6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
 7. Republic Conduit.
 8. Robroy Industries.
 9. Southwire Company.
 10. Thomas & Betts Corporation.
 11. Western Tube and Conduit Corporation.
 12. Wheatland Tube Company; a division of John Maneely Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. FMC: Comply with UL 1; zinc-coated steel.
- H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew.
 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. AFC Cable Systems, Inc.
 2. Anamet Electrical, Inc.
 3. Arnco Corporation.
 4. CANTEX Inc.
 5. CertainTeed Corp.

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6. Condux International, Inc.
 7. Electri-Flex Company.
 8. Kraloy.
 9. Lamson & Sessions; Carlon Electrical Products.
 10. Niedax-Kleinhuis USA, Inc.
 11. RACO; a Hubbell company.
 12. Thomas & Betts Corporation.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. ENT: Comply with NEMA TC 13 and UL 1653.
- D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. LFNC: Comply with UL 1660.
- F. Rigid HDPE: Comply with UL 651A.
- G. Continuous HDPE: Comply with UL 651B.
- H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
- I. RTRC: Comply with UL 1684A and NEMA TC 14.
- J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- K. Fittings for LFNC: Comply with UL 514B.
- L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Cooper B-Line, Inc.
 2. Hoffman; a Pentair company.
 3. Mono-Systems, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Adalet.
 - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 3. EGS/Appleton Electric.
 - 4. Erickson Electrical Equipment Company.
 - 5. FSR Inc.
 - 6. Hoffman; a Pentair company.
 - 7. Hubbell Incorporated; Killark Division.
 - 8. Kraloy.
 - 9. Milbank Manufacturing Co.
 - 10. Mono-Systems, Inc.
 - 11. O-Z/Gedney; a brand of EGS Electrical Group.
 - 12. RACO; a Hubbell Company.
 - 13. Robroy Industries.
 - 14. Spring City Electrical Manufacturing Company.
 - 15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
 - 16. Thomas & Betts Corporation.
 - 17. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

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- I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- K. Gangable boxes are allowed.
- L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Fiberglass.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- M. Cabinets:
 - 1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation; Hubbell Power Systems.
 - d. NewBasis.
 - e. Oldcastle Precast, Inc.; Christy Concrete Products.
 - f. Synertech Moulded Products; a division of Oldcastle Precast, Inc.
 - 2. Standard: Comply with SCTE 77.

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3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC."
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of hot-dip galvanized-steel diamond plate.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation; Hubbell Power Systems.
 - d. NewBasis.
 - e. Nordic Fiberglass, Inc.
 - f. Oldcastle Precast, Inc.; Christy Concrete Products.
 - g. Synertech Moulded Products; a division of Oldcastle Precast, Inc.
2. Standard: Comply with SCTE 77.
3. Color of Frame and Cover: Gray.
4. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
7. Cover Legend: Molded lettering, "ELECTRIC."
8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
9. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: GRC.
 3. Underground Conduit: RNC, Type EPC-80-PVC, and concrete encased under roadways, driveways and parking lots.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use setscrew fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. A. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- I. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- J. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

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- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with 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 according to NFPA 70.
- T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- V. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located

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where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- AA. Locate boxes so that cover or plate will not span different building finishes.
- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- DD. Set metal floor boxes level and flush with finished floor surface.
- EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Division 26 Section "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes with bottom below frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

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- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.6 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

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- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS**2.1 POWER RACEWAY IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.5 FLOOR MARKING TAPE

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
 - 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.7 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
 - 3. Nominal size, 7 by 10 inches (180 by 250 mm).

- D. Warning label and sign shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.8 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

2.9 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.10 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
1. Minimum Width: 3/16 inch (5 mm).

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2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.11 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 1. Outdoors: UV-stabilized nylon.
 2. In Spaces Handling Environmental Air: Plenum rated.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below

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finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

- J. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 20-foot (6-m) maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

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3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Limit use of underground-line warning tape to direct-buried cables.
 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

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- d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2. Equipment to Be Labeled:
- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchboards.
 - e. Emergency system boxes and enclosures.
 - f. Enclosed switches.
 - g. Enclosed controllers.
 - h. Power transfer equipment.
 - i. Contactors.
 - j. Power-generating units.

END OF SECTION 260553

SECTION 262416 - PANELBOARDS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, 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. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.

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5. Include evidence of NRTL listing for series rating of installed devices.
 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 7. Include wiring diagrams for power, signal, and control wiring.
 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
- C. Qualification Data: For qualified testing agency.
- D. Field Quality-Control Reports:
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals.
- G. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys: Two spares for each type of panelboard cabinet lock.
 2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
 3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NECA 407.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards 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.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet (2000 m).
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Owner no fewer than five days in advance of proposed interruption of electric service.
 - 2. Do not proceed with interruption of electric service without Owner's written permission.
 - 3. Comply with NFPA 70E.

1.9 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

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- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Flush- and surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Wash-Down] Areas: NEMA 250, Type 4X, stainless steel..
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 6. Finishes:
 - a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel Same finish as panels and trim.
 - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
 - 7. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
- C. Incoming Mains Location: Top and bottom.
- D. Phase, Neutral, and Ground Buses:

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1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
- E. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Main and Neutral Lugs: Mechanical type.
 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.
- I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

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- D. Mains: Circuit breaker or Lugs only; as indicated on drawings.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- G. Branch Overcurrent Protective Devices: Fused switches.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only; as indicated on the drawings.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, 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 circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

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- a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
- 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e.
 - f. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

2.5 PANELBOARD SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Current Technology; a subsidiary of Danahar Corporation.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 4. Liebert Corporation.
 - 5. Siemens Energy & Automation, Inc.
- B. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
 - 1. Accessories:
 - a. Fuses rated at 200-kA interrupting capacity.
 - b. Fabrication using bolted compression lugs for internal wiring.
 - c. Integral disconnect switch.
 - d. Redundant suppression circuits.
 - e. Redundant replaceable modules.
 - f. Arrangement with wire connections to phase buses, neutral bus, and ground bus.

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- g. LED indicator lights for power and protection status.
 - h. Audible alarm, with silencing switch, to indicate when protection has failed.
 - i. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - j. Six-digit, transient-event counter set to totalize transient surges.
- 2. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.
 - 3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
 - a. Line to Neutral: 70,000 A.
 - b. Line to Ground: 70,000 A.
 - c. Neutral to Ground: 50,000 A.
 - 4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
 - 5. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120 -V, three-phase, four-wire circuits shall be as follows:
 - a. Line to Neutral: 400 V for 208Y/120.
 - b. Line to Ground: 400 V for 208Y/120.
 - c. Neutral to Ground: 400 V for 208Y/120.

2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Receive, inspect, handle, and store panelboards according to NECA 407.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Mount top of trim 72 inches above finished floor unless otherwise indicated.
- E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- F. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- G. Install filler plates in unused spaces.
- H. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- J. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

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- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- E. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- F. Panelboards will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Weather-resistant receptacles.
 - 3. Snap switches.
 - 4. Wall-switch occupancy sensors.
 - 5. Communications outlets.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

1.5 SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 3. Leviton Mfg. Company Inc. (Leviton).
 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. Products: Subject to compliance with requirements, provide the following:
- a. Cooper; 5351 (single), CR5362 (duplex).
 - b. Hubbell; HBL5351 (single), HBL5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 GFCI RECEPTACLES

- A. General Description:
1. Straight blade, feed-through type.
 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide the following:
 - a. Cooper; VGF20.
 - b. Hubbell; GFR5352L.
 - c. Pass & Seymour; 2095.
 - d. Leviton; 7590.

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide the following:
 - a. Single Pole:
 - 1) Cooper; AH1221.
 - 2) Hubbell; HBL1221.
 - 3) Leviton; 1221-2.
 - b. Two Pole:
 - 1) Cooper; AH1222.
 - 2) Hubbell; HBL1222.
 - 3) Leviton; 1222-2.
 - 4) Pass & Seymour; CSB20AC2.
 - c. Three Way:
 - 1) Cooper; AH1223.
 - 2) Hubbell; HBL1223.
 - 3) Leviton; 1223-2.
 - 4) Pass & Seymour; CSB20AC3.
 - d. Four Way:
 - 1) Cooper; AH1224.
 - 2) Hubbell; HBL1224.
 - 3) Leviton; 1224-2.
 - 4) Pass & Seymour; CSB20AC4.

C. Pilot-Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide the following:
 - a. Cooper; AH1221PL for 120 and 277 V.
 - b. Hubbell; HBL1201PL for 120 and 277 V.
 - c. Leviton; 1221-LH1.

- d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.
- 2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

2.6 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Nylon 0.035-inch- (1-mm-) thick.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, thermoplastic with lockable cover.

2.7 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Emergency Power System: Red.
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:

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1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
 - 2. Test Instruments: Use instruments that comply with UL 1436.
 - 3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 SUBMITTALS

- A. Product Data: For each type of enclosed switch, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of NRTL listing for series rating of installed devices.

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5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For enclosed switches. Include plans, elevations, sections, details, and attachments to other work.
 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Operation and Maintenance Data: For enclosed switches to include in emergency, operation, and maintenance manuals.
- D. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 2. Fuse Pullers: Two for each size and type.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain enclosed switches, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NFPA 70.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
 2. Altitude: Not exceeding 6600 feet (2010 m).
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

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1. Notify Owner no fewer than five days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service. Owner's written permission.
3. Comply with NFPA 70E.

1.8 COORDINATION

- A. Coordinate layout and installation of switches and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS**2.1 FUSIBLE SWITCHES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with plug fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 5. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 6. Hookstick Handle: Allows use of a hookstick to operate the handle.
 7. Lugs: Mechanical type, suitable for number, size, and conductor material.
 8. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 5. Hookstick Handle: Allows use of a hookstick to operate the handle.
 6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOTOR SWITCH

- A. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - c. Rockwell Automation, Inc.; Allen-Bradley brand.
 - d. Siemens Energy & Automation, Inc.
 - e. Square D; a brand of Schneider Electric.
 2. Configuration: Nonreversing.
 3. Surface mounting.
 4. Red pilot light.
- B. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - c. Rockwell Automation, Inc.; Allen-Bradley brand.
 - d. Siemens Energy & Automation, Inc.
 - e. Square D; a brand of Schneider Electric.
2. Configuration: Nonreversing.
 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; melting alloy type.
 4. Surface mounting.
 5. Red pilot light.

2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 3R.
 3. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with 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. Install individual wall-mounted switches with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Enclosed switches will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
- B. Related Sections:
 - 1. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature.
- C. CRI: Color-rendering index.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Ballast, including BF.

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4. Energy-efficiency data.
 5. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Action Submittals" Article in Division 23 Section "Diffusers, Registers, and Grilles."
 6. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 23 Section "Diffusers, Registers, and Grilles."
 7. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
 8. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
 - b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Installation instructions.
- C. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
- D. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
- E. Field quality-control reports.
- F. Warranty: Sample of special warranty.
- G. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as

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defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.
- E. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

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- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- H. Diffusers and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
- I. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp and ballast characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
 - c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
 - d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
 - e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
 - f. CCT and CRI for all luminaires.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. General Requirements for Electronic Ballasts:
 - 1. Comply with UL 935 and with ANSI C82.11.
 - 2. Designed for type and quantity of lamps served.
 - 3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
 - 4. Sound Rating: Class A.
 - 5. Total Harmonic Distortion Rating: Less than 10 percent.
 - 6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - 7. Operating Frequency: 42kHz or higher.

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8. Lamp Current Crest Factor: 1.7 or less.
 9. BF: 0.88 or higher.
 10. Power Factor: 0.98 or higher.
 11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
- B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.
- C. Electronic Programmed-Start Ballasts for T8 Lamps: Comply with ANSI C82.11 and the following:
1. Automatic lamp starting after lamp replacement.
- D. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
1. Ballast Manufacturer Certification: Indicated by label.
- E. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.
1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.
 - b. Low-Level Operation: 50 percent of rated lamp lumens.
 2. Ballast shall provide equal current to each lamp in each operating mode.
 3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

- A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
1. Lamp end-of-life detection and shutdown circuit.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: Class A.
 4. Total Harmonic Distortion Rating: Less than 20 percent.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. BF: 0.95 or higher unless otherwise indicated.
 9. Power Factor: 0.98 or higher.
 10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 BALLASTS FOR HID LAMPS

- A. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
1. Minimum Starting Temperature: Minus 20 deg F (Minus 29 deg C) for single-lamp ballasts.
 2. Rated Ambient Operating Temperature: 130 deg F (54 deg C).
 3. Lamp end-of-life detection and shutdown circuit.
 4. Sound Rating: Class A.
 5. Total Harmonic Distortion Rating: Less than 20 percent.
 6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 7. Lamp Current Crest Factor: 1.5 or less.
 8. Power Factor: 0.90 or higher.
 9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
 10. Protection: Class P thermal cutout.

2.6 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2.7 EMERGENCY LIGHTING UNITS

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
1. Battery: Sealed, maintenance-free, lead-acid type.
 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
 7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
 8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

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9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.8 FLUORESCENT LAMPS

- A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 4100 K, and average rated life 20,000 hours unless otherwise indicated.
- B. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 4100 K, average rated life of 10,000 hours at three hours operation per start unless otherwise indicated.
 1. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).

2.9 HID LAMPS

- A. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and color temperature 4000 K.
- B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.
- C. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

2.10 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).
- F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION**3.1 INSTALLATION****A. Lighting fixtures:**

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.**C. Lay-in Ceiling Lighting Fixtures Supports:** Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

D. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."**3.2 IDENTIFICATION****A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."**

3.3 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.
- C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

- A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

END OF SECTION 265100

ITEM 627.0027 25**COMMUNICATIONS****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the attached Specification Summary.
- 1.02 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0027 25**COMMUNICATIONS****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

- A. Section 270500 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. Section 271500 COMMUNICATION CABLING

1.02 This item shall include, but not be limited to, the following:

- A. Details and equipment related to IT and communications systems.

SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Communications equipment coordination and installation.
 - 2. Common communications installation requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of communications equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS – Not Used.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

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- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 270500

SECTION 271500 - COMMUNICATIONS CABLING

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. UTP cabling.
 - 2. 62.5/125-micrometer, optical fiber cabling.
 - 3. Coaxial cable.
 - 4. Cable connecting hardware, patch panels, and cross-connects.
 - 5. Telecommunications outlet/connectors.
 - 6. Cabling system identification products.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- D. EMI: Electromagnetic interference.
- E. IDC: Insulation displacement connector.
- F. LAN: Local area network.
- G. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.
- H. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- I. RCDD: Registered Communications Distribution Designer.
- J. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Testing Agency Qualifications: An NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test optical fiber cables to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
 - 2. Test optical fiber cables while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; including the loss value of each. Retain test data and include the record in maintenance data.
 - 3. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS**2.1 HORIZONTAL CABLING DESCRIPTION**

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
 3. Bridged taps and splices shall not be installed in the horizontal cabling.
 4. Splitters shall not be installed as part of the optical fiber cabling.
- B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 50 or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Grounding: Comply with J-STD-607-A.

2.3 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).

2.4 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. ADC.

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2. Belden Inc.
3. Berk-Tek; a Nexans company.
4. CommScope, Inc.
5. Draka Cableteq USA.
6. Genesis Cable Products; Honeywell International, Inc.
7. Mohawk; a division of Belden Networking, Inc.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope, Inc. brand.
10. 3M Communication Markets Division.
11. Tyco Electronics Corporation; AMP Products.

B. Description: 100-ohm, four-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 5e Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG; or MPP, CMP, MPR, CMR, MP, or MPG.
 - b. Communications, Plenum Rated: Type CMP or MPP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR; or MPP, CMP, or MPR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG.
 - e. Multipurpose: Type MP or MPG; or MPP or MPR.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - g. Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.

2.5 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. ADC.
2. American Technology Systems Industries, Inc.
3. Belden Inc.
4. Dynacom Inc.
5. Hubbell Premise Wiring.
6. Leviton Commercial Networks Division.
7. Molex Premise Networks; a division of Molex, Inc.
8. Panduit Corp.
9. Simon Co. (The).
10. Tyco Electronics Corporation; AMP Products.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

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- C. Connecting Blocks: 110-style IDC for Category 5e. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 - 1. Number of Terminals per Field: One for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 - 1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made, four-pair cables in 36-inch (900 mm) lengths; terminated with eight-position modular plug at each end.
 - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 - 2. Patch cords shall have color-coded boots for circuit identification.

2.6 OPTICAL FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Belden Inc.
 - 2. Berk-Tek; a Nexans company.
 - 3. CommScope, Inc.
 - 4. Corning Cable Systems.
 - 5. CSI Technologies Inc.
 - 6. General Cable Technologies Corporation.
 - 7. Mohawk; a division of Belden Networking, Inc.
 - 8. Superior Essex Inc.
 - 9. SYSTIMAX Solutions; a CommScope, Inc. brand.
 - 10. 3M Communication Markets Division.
 - 11. Tyco Electronics Corporation; AMP Products.
- B. Description: Multimode, 62.5/125-micrometer, 24-fiber, nonconductive, tight buffer, optical fiber cable.
 - 1. Comply with ICEA S-83-596 for mechanical properties.
 - 2. Comply with TIA/EIA-568-B.3 for performance specifications.
 - 3. Comply with TIA-492AAAA-A for detailed specifications.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

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- a. General Purpose, Nonconductive: Type OFN or OFNG, or OFNR, OFNP.
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC or OFCG; or OFNG, OFN, OFCR, OFNR, OFCP, or OFNP.
 - e. Plenum Rated, Conductive: Type OFCP or OFNP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR; or OFNR, OFCP, or OFNP, complying with UL 1666.
5. Conductive cable shall be aluminum armored type.
 6. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
 7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
- C. Jacket:
1. Jacket Color: Orange.
 2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
 3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.7 OPTICAL FIBER CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. ADC.
 2. American Technology Systems Industries, Inc.
 3. Belden Inc.
 4. Berk-Tek; a Nexans company.
 5. Corning Cable Systems.
 6. CSI Technologies Inc.
 7. Dynacom Inc.
 8. Hubbell Premise Wiring.
 9. Molex Premise Networks; a division of Molex, Inc.
 10. Siemon Co. (The).
- B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
- C. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.
- D. Cable Connecting Hardware:
1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 2. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.75 dB.
 3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.8 COAXIAL CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Alpha Wire Company.
 2. Belden Inc.
 3. Coleman Cable, Inc.
 4. CommScope, Inc.
 5. Draka Cableteq USA.
- B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- C. RG-11/U: NFPA 70, Type CATV.
1. No. 14 AWG, solid, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 4. Jacketed with sunlight-resistant, black PVC or PE.
 5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- D. RG-6/U: NFPA 70, Type CATV or CM.
1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 3. Jacketed with black PVC or PE.
 4. Suitable for indoor installations.
- E. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
1. CATV Cable: Type CATV, or CATVP or CATVR.
 2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 3. CATV Riser Rated: Type CATVR; or CATVP, CATVR, or CATV, complying with UL 1666.
 4. CATV Limited Rating: Type CATVX.

2.9 COAXIAL CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Emerson Network Power Connectivity Solutions.
 2. Leviton Commercial Networks Division.
 3. Siemon Co. (The).
- B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.10 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets: Four-port-connector assemblies mounted in single faceplate.
 - 1. Plastic Faceplate: Nylon. Coordinate color with Division 26 Section "Wiring Devices."
 - 2. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
 - a. Flush mounting jacks, positioning the cord at a 45-degree angle.
 - 3. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.11 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with J-STD-607-A.

2.12 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.13 SOURCE QUALITY CONTROL

- A. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
- B. Factory test UTP cables according to TIA/EIA-568-B.2.
- C. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.
- D. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- E. Cable will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal pathways and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
 - 2. Install lacing bars and distribution spools.
 - 3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. MUTOA shall not be used as a cross-connect point.
 - 5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for UTP at least 49 feet (15 m) from communications equipment room.
 - 6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

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8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 12. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
1. Comply with TIA/EIA-568-B.2.
 2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- D. Optical Fiber Cable Installation:
1. Comply with TIA/EIA-568-B.3.
 2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
- E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- F. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Coil cable 6 feet (1800 mm) long not less than 12 inches (300 mm) in diameter below each feed point.
- G. Outdoor Coaxial Cable Installation:
1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
- H. Group connecting hardware for cables into separate logical fields.

I. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
 - 1. Administration Class: 1.
 - 2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
- C. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- D. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.
- E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- F. Cable and Wire Identification:
 - 1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

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3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
 6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.
- G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections:
 1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 2. Visually confirm Category 5e, marking of outlets, cover plates, outlet/connectors, and patch panels.
 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

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5. Optical Fiber Cable Tests:

- a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- b. Link End-to-End Attenuation Tests:
 - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

6. UTP Performance Tests:

- a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.
 - 10) Delay skew.

7. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.3.

8. Coaxial Cable Tests: Conduct tests according to Division 27 Section "Master Antenna Television System."

9. Final Verification Tests: Perform verification tests for UTP and optical fiber systems after the complete communications cabling and workstation outlet/connectors are installed.

- a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
- b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

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- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 271500

ITEM 627.0031 25**EARTHWORK****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the Specification Sections listed below
- 1.04 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0031 25**EARTHWORK****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

- A. Section 311000 SITE CLEARING
- B. Section 312000 EARTH MOVING
- C. Section 312319 DEWATERING
- D. Section 315000 EXCAVATION SUPPORT AND PROTECTION

1.02 This item shall include, but not be limited to, the following:

- A. Site work needed for the construction of the building's addition, including earthwork and preparation

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Protecting existing vegetation to remain.
 2. Removing existing vegetation.
 3. Clearing and grubbing.
 4. Stripping and stockpiling topsoil.
 5. Stripping and stockpiling rock.
 6. Removing above- and below-grade site improvements.
 7. Disconnecting, capping or sealing, and removing site utilities abandoning site utilities in place.
 8. Temporary erosion and sedimentation control.

1.2 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.
- D. 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.
- E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and as indicated on Drawings.
- G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 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.

1.4 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.

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2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.
- B. Topsoil stripping and stockpiling program.
- C. Rock stockpiling program.
- D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.
- E. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.5 QUALITY ASSURANCE

- A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.
- B. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

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. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises.
- D. Utility Locator Service: Notify **Call Before You Dig or Dig Safe System** for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.
- F. 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 312000 "Earth Moving."
 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. 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 Section 015639 "Temporary Tree and Plant Protection."
- 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 TREE AND PLANT PROTECTION

- A. Protect trees and plants remaining on-site.
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations.

3.4 EXISTING UTILITIES

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
 - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed **or abandoned in place**.
 - 1. Arrange with utility companies to shut off indicated utilities.
 - 2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than **two** days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.

- E. Excavate for and remove underground utilities indicated to be removed.
- F. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024119 "Selective Demolition."

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth indicated on Drawings or not less than 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects 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. Do not stockpile topsoil within protection zones.
 - 2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
 - 3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Burning tree, shrub, and other vegetation waste is permitted according to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited.

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- C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses.
 2. Mass excavations
 3. Excavating and backfilling for buildings and structures.
 4. Subbase course for concrete and asphalt paving.
 5. Subsurface drainage backfill for walls and trenches.
 6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
1. Geotextiles.
 2. Controlled low-strength material, including design mixture.
 3. Warning tapes.

1.3 INFORMATIONAL 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 D 2487.
 2. Laboratory compaction curve according to ASTM D 1557.
- B. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.
- C. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
1. Do not proceed with work on any adjoining property until directed by Owner's Representative.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

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- D. Subbase Material: Material shall be clean, sound, consisting of either gravel, stone, slag, and sands meeting the requirements of the local State Department of Transportation /Agency (State DOT) or local highway Specifications. Stone sizing and type as specified on Contract Drawings.
- E. Crushed Stone Fill - Material shall be clean, sound, washed or unwashed, crushed stone of uniform quality. It shall be a 50-50 mixture of NYSDOT size designation #1 and #2 stone as per NYSDOT Standard Specifications (703-02).
- F. Select Granular Fill: Material shall meet the requirements for select granular fill Item 203.07 as defined in the New York State Department of Transportation "Standard Specifications".
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 5 percent passing a No. 200 sieve.
- H. Drainage Course: Material shall meet the requirements of Item 605.0901, Type 1, or a 50-50 mixture of Type I and Type II (605.1001) as defined in the New York State Department of Transportation "Standard Specification".
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate.
- K. Stone Filling (Riprap) – meeting New York State Department of Transportation "Standard Specification" Section 620.0 . Size as indicated on the drawings.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefin or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Grab Tensile Strength: >157 lbf; ASTM D 4632.
 - 2. Sewn Seam Strength: >142 lbf; ASTM D 4632.
 - 3. Tear Strength: >56 lbf; ASTM D 4533.
 - 4. Puncture Strength: >56 lbf; ASTM D 4833.
 - 5. Apparent Opening Size: **No. 40** sieve, maximum; ASTM D 4751.
 - 6. Permittivity: 0.5 per second, minimum; ASTM D 4491.
 - 7. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefin or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Grab Tensile Strength: >**247 lbf**; ASTM D 4632.
 - 2. Sewn Seam Strength: >**222 lbf**; ASTM D 4632.
 - 3. Tear Strength: >**90 lbf**; ASTM D 4533.
 - 4. Puncture Strength: >**90 lbf**; ASTM D 4833.
 - 5. Apparent Opening Size: **No. 60** sieve, maximum; ASTM D 4751.
 - 6. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - 7. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:
1. Portland Cement: ASTM C 150, Type I or Type II.
 2. Fly Ash: ASTM C 618, Class C or F.
 3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
 4. Foaming Agent: ASTM C 869.
 5. Water: ASTM C 94/C 94M.
 6. Air-Entraining Admixture: ASTM C 260.

2.4 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations and trenches from ponding on prepared subgrades, and from flooding work areas, Project site and surrounding areas.
- 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.
- C. All water removed from the trenches or excavations by pumping, bailing, siphoning, well-points, or other means shall be disposed of in such a manner that avoids damage to the work, work of other Contractors, surface and ground water, persons or property. Unless otherwise permitted by the Engineer, groundwater encountered within the limits of excavation shall be depressed to an elevation not less than 12 inches below the bottom thereof before pipe laying or concreting is started, and shall be so maintained until concrete and joint material have attained adequate strength.

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- D. The Contractor shall not discharge water from dewatering operations directly into any line or intermittent stream, channel, wetlands or surface water. The Contractor shall not discharge water from dewatering operations directly into the storm or sanitary sewer system without prior approval of the Engineer. If in the opinion of the Engineer, water from dewatering operations contains unacceptable amounts of sediment, the water shall be treated by filtration, sedimentation basins, or other methods to reduce the amount of sediment contained in the water to allowable levels, as acceptable to the Engineer, prior to disposal.
- E. Upon completion of the section wherein the operations have been performed, the Contractor shall remove from the catch basins, ditches, and swales, all mud, silt, debris, and other accumulations discharged to these various locations. The Contractor is responsible for leaving them in a condition similar to that which existed prior to his operations. Proper control measures shall be employed, to minimize siltation and erosion in and adjacent to the area of work.

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.
 - 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction.

3.4 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 safely 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.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

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 as required.
- 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.
- 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.

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1. For pipes and conduit less than **6 inches** in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 2. For pipes and conduit **6 inches** or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
 4. Excavate trenches **6 inches** deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: Excavate trenches **4 inches** deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
1. Excavate trenches **6 inches** deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- E. Trenches in Tree- and Plant-Protection Zones:
1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

3.7 SUBGRADE INSPECTION

- A. Notify Owner's Representative when excavations have reached required subgrade.
- B. If Owner's Representative determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than **15 tons** to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction. Limit vehicle speed to **3 mph**.
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Owner's Representative. Place No. 3/No. 4 size stone to stabilize subgrades as directed by Engineer or onsite geotechnical engineer and approved by Owner's Representative. Replace excavated soil with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for per Contract provisions for unit prices or changes in the Work as applicable.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner's Representative, 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 **2,500 psi**, may be used when approved by Owner's Representative.
1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Owner's Representative.

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, damp proofing, 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. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.
- D. Backfill voids with satisfactory soil while removing shoring and bracing.
- E. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.
- F. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- G. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

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 grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than **8 inches** in loose depth for material compacted by heavy compaction equipment, and not more than **4 inches** in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight per ASTM D 1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top **12 inches** of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top **6 inches** below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 - 3. Under turf or unpaved areas, scarify and recompact top **6 inches** below subgrade and compact each layer of backfill or fill soil material at 90 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent for non-traffic areas and 95% for traffic areas.

3.15 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus **1 inch**.
 - 2. Walks: Plus or minus **1/2 inch**.
 - 3. Pavements: Plus or minus **1/2 inch**.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of **1/2 inch** when tested with a **10-foot** straightedge.

3.16 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade per manufacturer's written instructions, overlapping sides and ends, if required.
 - 2. Shape subbase course to required crown elevations and cross-slope grades.

3. Place subbase course **6 inches** or less in compacted thickness in a single layer.
4. Place subbase course that exceeds **6 inches** in compacted thickness in layers of equal thickness, with no compacted layer more than **6 inches** thick or less than **3 inches** thick.
5. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight per ASTM D 1557.

3.17 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 1. Install subdrainage geotextile on prepared subgrade per manufacturer's written instructions, overlapping sides and ends.
 2. Place drainage course **6 inches** or less in compacted thickness in a single layer.
 3. Place drainage course that exceeds **6 inches** in compacted thickness in layers of equal thickness, with no compacted layer more than **6 inches** thick or less than **3 inches** thick.
 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight per ASTM D 698.

3.18 FIELD QUALITY CONTROL

- A. Special Inspections: Owner may 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 may engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Owner's Representative.
- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,500 square feet or less of paved area or building slab, but in no case fewer than three tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 50 lineal feet or less of wall length, but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 50 lineal feet or less of trench length, but no fewer than two tests.

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- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 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 Owner's Representative; 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.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory liquid, soil and waste materials, including dewatering liquids, silt, unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

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SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Division 01 Specification Sections, apply to this Section.

1.2 ACTION SUBMITTALS

- A. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional engineer.
1. Include plans, elevations, sections, and details.
 2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
 3. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
 4. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.

1.3 FIELD CONDITIONS

- A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.
1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
- B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain 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.
1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.
 2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
 3. Prevent surface water from entering excavations by grading, dikes, or other means.

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4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 5. Remove dewatering system when no longer required for construction.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

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 dewatering operations.
1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Protect and maintain temporary erosion and sedimentation controls, during dewatering operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
1. Space well points or wells at intervals required to provide sufficient dewatering.
 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.
- C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

- A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

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2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
- C. 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.
- D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

- A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.
 1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
 2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
 3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.
- B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.
- C. Prepare reports of observations.

3.5 PROTECTION

- A. Protect and maintain dewatering system during dewatering operations.
- B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 312319

SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes temporary excavation support and protection systems.

1.3 SUBMITTALS

- A. Delegated-Design Submittal: For excavation support and protection systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Professional Engineer: Experience with providing delegated-design engineering services of the type indicated, including documentation that engineer is licensed in the State in which Project is located.
- B. Architect/Engineer will not be responsible for review shoring design. Furnish record copy for Architect and Engineer.

1.4 FIELD CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify **Owner** no fewer than **two** days in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection according to the performance requirements.
- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.

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1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
4. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

2.2 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition and shall be provided with enough size and strength rating as determined by the application.
- B. Excavation shoring or underpinning materials shall be designed and provided to resist the influence of loads from adjacent existing structures, roadways, etc. shown on the Contract Drawings as well as supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.

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 that could develop during excavation support and protection system operations.
 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

3.2 SOLDIER PILES AND LAGGING

- A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than **2 inches from a horizontal line and not more than 1:120 out of vertical alignment**].
- B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.3 SHEET PILING

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.
- B. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to **60 inches**. Accurately align exposed faces of sheet piling to vary not more than **2 inches from a horizontal line and not more than 1:120 out of vertical alignment**.
- C. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

- A. Drill, install, grout, and tension tiebacks.
- B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
 - 1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.
- C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.5 BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
 - 1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
 - 2. Install internal bracing if required to prevent spreading or distortion of braced frames.
 - 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 FIELD QUALITY CONTROL

- A. Survey-Work Benchmarks: Resurvey benchmarks **regularly** during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.
- B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.
- C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.7 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
 - 1. Remove excavation support and protection systems to a minimum depth of **48 inches** below overlying construction and abandon remainder.
 - 2. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."

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3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

END OF SECTION 315000

ITEM 627.0032 25**EXTERIOR IMPROVEMENTS****1. DESCRIPTION:**

- 1.01 Furnish all labor, materials, equipment and services necessary to complete the work as indicated on the Contract Plans and the Specification Sections listed below
- 1.04 All work shall conform to the requirements specified in Part 1 – General, of the Sections listed.

2. MATERIALS:

- 2.01 The materials shall be as specified in Part 2 – Products, of the Sections listed.

3. CONSTRUCTION DETAILS:

- 3.01 The construction details shall be as specified on Part 3 – Execution, if the Sections listed.

4. METHOD OF MEASUREMENT:

- 4.01 This item shall be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

5. BASIS OF PAYMENT:

- 5.01 Payment for this item shall be made at the lump sum bid price bid. The lump sum price bid shall include cost of furnishing all labor, material, equipment and appliances necessary to complete the work as indicated on the Contract Plans and as specified herein in the Sections listed.
- 5.02 Detailed Estimate:
 - A. Before the first certificate of payment is issued for the work under this item, submit a detailed estimate of quantities and prices for all materials, labor, and other items included under this item, which shall aggregate the contract lump sum price bid for this item. Prepare the detailed estimate in the same sequence as the Sections listed.
 - B. The detailed estimate shall be supported by such evidence, including certified copies of subcontracts, as the Engineer may require.
 - C. The detailed estimate must be approved by the Engineer who may revise it as, in his/her reasonable judgment, is necessary to make the various item conform to their true values. The value of each certificate of payment will be based on the approved detailed estimate.
- 5.03 Monthly payments will be made for this item in proportion to the total amount of work completed.

ITEM 627.0032 25**EXTERIOR IMPROVEMENTS****1. SPECIFICATION SUMMARY**

1.01 This Item includes the following specifications:

- A. Section 321216 ASPHALT PAVING
- B. Section 321723 PAVEMENT MARKINGS
- C. Section 323113 FENCES AND GATES
- D. Section 329200 TURF AND GRASSES

1.02 This item shall include, but not be limited to, the following:

- A. New paving around the building, including the addition of new parking spaces
- B. New green space around the building

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Hot-mix asphalt patching.
 2. Hot-mix asphalt paving.
 3. Hot-mix asphalt overlay.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
1. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include technical data and tested physical and performance properties.
 2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
 3. Job-Mix Designs: For each job mix proposed for the Work.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: For each paving material, by a qualified testing agency.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
1. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 2. Asphalt Surface Course: Minimum surface temperature of 50 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: Sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag meeting the NYSDOT requirements for Coarse Aggregate 703-02.
- C. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof meeting the NYSDOT requirements for Fine Aggregate 703-01.
1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D 242/D 242M, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: NYSDOT Performance Grade Binder designation PG 64S-22.
- B. Asphalt Cement: Meeting the requirements of NYSDOT Table 702-2.
- C. Tack Coat: Meeting the requirements of NYSDOT Table 702-5 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- D. Water: Potable.

2.3 AUXILIARY MATERIALS

- A. Paving Geotextile: Where specified on Contract Drawings. AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- B. Joint Sealant: ASTM D 6690, Type II, hot-applied, single-component, polymer-modified bituminous sealant on NYSDOT-Approved List.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes in compliance with the with NYSDOT specification mix requirements. If not otherwise called out on the drawings (plans), provide the following:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Base Course: NYSDOT 37.5 F9 HMA 80 Series.
 - 3. Binder Course: NYSDOT 19 F9 HMA 80 Series.
 - 4. Top Course: NYSDOT 9.5 F2 HMA 80 Series..
- B. Emulsified-Asphalt Slurry: ASTM D 3910, Type 1.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to **3 mph**.
 - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than **15 tons**.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.3 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
1. Mill to a depth as indicated on the Contract Documents.
 2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
 3. Control rate of milling to prevent tearing of existing asphalt course.
 4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling.
 5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
 6. Patch surface depressions deeper than **1 inch** after milling, before wearing course is laid.
 7. Unless otherwise specified in the Contract Documents, remove and legally dispose of milling from the site.
 8. Keep milled pavement surface free of loose material and dust.
 9. Do not allow milled materials to accumulate on-site.

3.4 PATCHING

- A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending **12 inches** into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
1. Undersealing: Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
 2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of **0.05 to 0.15 gal./sq. yd.**
1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.5 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than **1 inch** in existing pavements.
1. Install leveling wedges in compacted lifts not exceeding **3 inches** thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of **1/4 inch**.
1. Clean cracks and joints in existing hot-mix asphalt pavement.
 2. Use emulsified-asphalt slurry to seal cracks and joints less than **1/4 inch** wide. Fill flush with surface of existing pavement and remove excess.

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3. Use hot-applied joint sealant to seal cracks and joints more than **1/4 inch** wide. Fill flush with surface of existing pavement and remove excess.

3.6 SURFACE PREPARATION

- A. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of **0.05 to 0.15 gal./sq. yd.**
 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.7 PAVING GEOTEXTILE INSTALLATION (IF REQUIRED)

- A. Apply tack coat uniformly to existing pavement surfaces at a rate of **0.20 to 0.30 gal./sq. yd.**
- B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints **4 inches** and transverse joints **6 inches**.
- C. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.

3.8 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 1. Place hot-mix asphalt base and binder course in single lifts.
 2. Place hot-mix asphalt surface course in single lift.
 3. Spread mix at a minimum temperature of **250 deg F**.
 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than **10 feet** wide unless infill edge strips of a lesser width are required.
 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about **1 to 1-1/2 inches** from strip to strip to ensure proper compaction of mix along longitudinal joints.
 2. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.9 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of **6 inches**.
 3. Offset transverse joints, in successive courses, a minimum of **24 inches**.

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4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time.
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.10 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 1. Complete compaction before mix temperature cools to **185 deg F**.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent or greater than 100 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.11 ASPHALT CURBS (IF REQUIRED)

- A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of **250 deg F**.
 1. Asphalt Mix: Same as pavement surface-course mix.
- B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.12 ASPHALT TRAFFIC-CALMING DEVICES (IF REQUIRED)

- A. Construct hot-mix asphalt speed humps over compacted pavement surfaces. Apply a tack coat unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of **250 deg F**.
 1. Tack Coat Application: Apply uniformly to surfaces of existing pavement at a rate of **0.05 to 0.15 gal./sq. yd.**

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2. Asphalt Mix: Same as pavement surface-course mix.
 3. Before installation, mill pavement that will be in contact with bottom of traffic-calming device. Mill to a depth of **1 inch** from top of pavement to a clean, rough profile.
- B. Place and compact hot-mix asphalt to cross section indicated, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.13 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
1. Base Course: Plus or minus **1/2 inch**.
 2. Surface Course: Plus **1/4 inch**, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a **10-foot** straightedge applied transversely or longitudinally to paved areas:
1. Base Course: **1/4 inch**.
 2. Surface Course: **1/8 inch**.
 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is **1/4 inch**.
- C. Asphalt Traffic-Calming Devices: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus **1/8 inch** of height indicated above pavement surface.

3.14 SURFACE TREATMENTS (IF REQUIRED)

- A. Fog Seals: Apply fog seal at a rate of **0.10 to 0.15 gal./sq. yd.** to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.
- B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.
1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549/D 3549M.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979/D 979M.
1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041/D 2041M, and compacted according to job-mix specifications.
 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726/D 2726M.

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- a. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726/D 2726M.
- F. Replace and compact hot-mix asphalt where core tests were taken, if any.
- G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 321216

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes painted markings applied to asphalt and concrete pavement.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to marking pavement including, but not limited to, the following:
 - a. Pavement aging period before application of pavement markings.
 - b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include technical data and tested physical and performance properties.
- B. Shop Drawings: For pavement markings.
1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
 2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of NYSDOT for pavement-marking work for any work within public right-of-way.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55° and a maximum of 95°.

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKING PAINT

- A. Formulated for use as a pavement marking material.
- B. Be VOC compliant and lead chromate free.
- C. Yellow paints must use organic yellow pigments Color Index Pigment Yellow 65 (C.I. 11740) and/or 74 (C.I. 11741).
- D. Display no bleeding on the surface upon which the paint is applied.
- E. Conform to current Federal, State and Local air pollution regulations, including those for the control (emission) of volatile organic compounds (VOC) as established by the U.S. EPA, and the NYSDEC
- F. % Pigment. (ASTM D3723) 58.0% – 62.0%

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- G. % Total Solids. (ASTM D3723) 76.0 % minimum
- H. % Vehicle Non-Volatile. (ASTM D3723) 43.0 % minimum
- I. Directional Reflectance (ASTM E1347)
 - 1. White: 84% minimum
 - 2. Yellow: 54% minimum

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 Owner's Representative.
- B. Allow paving to age for a minimum of 30 days before starting pavement marking, unless approved in writing by Owner's Representative.
- 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.
 - 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.

3.3 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear until completely dry, as recommended by paint manufacturer.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

SECTION 32 3113 - FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Chain-link fences.
 2. Wood rail fencing
 3. Backstops
 4. Swing gates.
 5. Horizontal-slide gates.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Gates and hardware.
- B. Shop Drawings: For each type of fence and gate assembly.
1. Include plans, elevations, sections, details, and attachments to other work.
 2. Include accessories, hardware, gate operation, and operational clearances.
- C. Samples for Initial Selection: For each type of factory-applied finish.

1.4 FIELD CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.5 WARRANTY

- A. Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Failure to comply with performance requirements.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Match Existing Fence or Provide fabric in one-piece heights measured between top and bottom of outer edge of selva knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:

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1. Fabric Height: As indicated on Drawings.
2. Fabric Gage: As indicated on Contract Drawings. 9-gage if not indicated.
 - a. Mesh Size: **2 inches**. 1.75 inches for tennis court applications as required.
 - b. Fabric Heights 8-foot or greater. Zinc-Coated Fabric: ASTM A 392, Type II, with zinc coating applied before weaving.
 - c. Fabric Heights 6-foot or less. Polymer-Coated Fabric: ASTM F 668, Class 2A, fusion-bonded and adhered to 9 gage steel wire, applied before weaving. Color shall be Black.
 - d. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.
3. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMEWORK

- A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
 1. Fence Height: As indicated on Drawings.
 2. Industrial-Strength Material: Group IC, Standard Weight, Schedule 40, round steel pipe, electric-resistance-welded pipe, 50,000 PSI minimum yield strength.
 - a. Line Post: As indicated on Contract Drawings.
 - b. End, Corner, and Pull Posts: As indicated on Contract Drawings.
 3. Horizontal Framework Members: Intermediate top and bottom rails according to ASTM F 1043.
 - a. Top / Bottom Rail: **1.66 inches** in diameter.
 4. Brace Rails: ASTM F 1043.
 5. Metallic Coating for Steel Framework 6-><foot or greater:
 - a. Type A: Not less than minimum **2.0-oz./sq. ft.** average zinc coating according to ASTM A 123/A 123M or **4.0-oz./sq. ft.** zinc coating according to ASTM A 653/A 653M.
 - b. Polymer coating matching fabric over metallic coating for framework less than less than 6-foot. Color shall be Black.

2.3 WOOD RAIL FENCING

- A. 2-rail "American Style" Split Rail System. 36-inch height.
- B. 6" x 6" post, 36-inch burial depth, 8-foot post spacing.
- C. Western red cedar posts and rails.
- D. Stainless steel hardware.

2.4 SWING GATES

- A. General: ASTM F 900 for gate posts and single and double swing gate types, as indicated on the Contract Drawings.
 1. Gate Leaf Width: As indicated and shall be clear opening width.
- B. Pipe and Tubing:
 1. Zinc-Coated Steel: ASTM F 1043 and ASTM F 1083; manufacturer's standard protective coating and finish.
 2. Gate Posts: Round tubular steel.
 3. Gate Frames and Bracing: Round tubular steel.

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- C. Frame Corner Construction: Welded.
- D. Hardware:
 - 1. Hinges: Commercial grade - 360-degree inward and outward swing.
 - 2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate. Coordinate hasp size with Owner locks.

2.5 HORIZONTAL-SLIDE GATES (Where indicated on Contract Drawings)

- A. General: ASTM F 1184 for gate posts and single sliding gate types.
 - 1. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
 - a. Gate Frame Width and Height: As indicated.
- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: Manufacturer's standard protective coating and finish.
 - 2. Gate Posts: ASTM F 1184. Provide round tubular steel posts.
 - 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded with end caps.
- D. Hardware:
 - 1. Hangers, Roller Assemblies, and Stops: Fabricated from galvanized steel.
 - 2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
 - 3. Lock: Manufacturer's standard internal device.

2.6 FITTINGS

- A. Provide fittings according to ASTM F 626.
- B. Post Caps: Provide for each post.
 - 1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 - 1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than **6 inches** long.
 - 2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than **2 inches** shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
 - a. Hot-Dip Galvanized Steel: **0.148-inch**-diameter wire.
 - b. Aluminum: **ASTM B 211**; Alloy 1350-H19; **0.148-inch**-diameter, mill-finished wire.

2.7 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of **500 feet** or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.
 - 1. Install fencing on established boundary lines inside property line.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend **2 inches** above grade; shape and smooth to shed water.
 - b. Concealed Concrete: Place top of concrete below grade as indicated on Drawings to allow covering with surface material.
 - c. Posts Set into Sleeves in Concrete: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
 - d. Posts Set into Holes in Concrete: Form or core drill holes not less than **5 inches** deep and **3/4 inch** larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed according to anchoring material

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manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.

- D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.
- E. Line Posts: Space line posts uniformly at as indicated on the contract documents, with a maximum post spacing of 10 feet for fence heights of six feet or less.
- F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 - 1. Locate horizontal braces at mid-height of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- H. Intermediate and Bottom Rails: Secure to posts with fittings.
- I. Chain-Link Fabric: Apply fabric to outside of enclosing frame work or facing athletic field areas. Leave 1-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.
- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side.

3.4 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding and are compatible with Owner locks.
- B. Lubricate hardware and other moving parts.

END OF SECTION 323113

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SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Seeding.
 - 2. Hydroseeding.
 - 3. Sodding.

1.2 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- C. 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.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer.
- 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.
 - 1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.
- C. Product Certificates: For fertilizers, from manufacturer.

1.5 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.

1.6 FIELD CONDITIONS

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS**2.1 SEED**

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species:
 - 1. Quality: State-certified seed of grass species as listed below for solar exposure.
 - 2. Sun and Partial Shade: Proportioned by weight as follows:
 - a. 50 percent Kentucky bluegrass (*Poa pratensis*).
 - b. 30 percent chewings red fescue (*Festuca rubra* variety).
 - c. 10 percent perennial ryegrass (*Lolium perenne*).
 - d. 10 percent redtop (*Agrostis alba*).
 - 3. Shade: Proportioned by weight as follows:
 - a. 50 percent chewings red fescue (*Festuca rubra* variety).
 - b. 35 percent rough bluegrass (*Poa trivialis*).
 - c. 15 percent redtop (*Agrostis alba*).

2.2 TURFGRASS SOD

- A. Sod shall be commercially grown sod and shall be accompanied by a certificate indicating compliance with the regulations of the NYS Department of Agriculture and Markets. Athletic field sod shall be 100% tall fescue.
- B. Sod shall be cut into squares or rectangular portions which shall be a minimum of 12 inches wide, or as approved, and may vary in length, but shall be of a size which will permit them to be lifted without breaking. Height of the grass shall not exceed 3 inches. The sod shall be cut to a minimum thickness of 3/4 inch. The sod shall be reasonably free from weeds in conformance with accepted commercial practice. The sod shall consist of a mixture of at least three permanent grasses such as bluegrass and fine leaved fescues, unless otherwise specified. Sod that is heat damaged or fermenting will be rejected.
- C. Sod shall be delivered to the job within 24 hours after being cut and installed within 48 hours after being cut. The sod, when delivered to the contract site and during the time it is held on site, shall be sufficiently moist so the soil will adhere firmly to the roots when it is handled.
- D. Sod will be accepted based on inspection for compliance with the material

2.3 FERTILIZERS

- 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: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

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- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.4 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
- B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- D. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.5 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.
- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.
- C. Erosion-Control Mats: Cellular, nonbiodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 3-inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.

PART 3 - EXECUTION**3.1 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.

3.2 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.

3.3 TURF AREA PREPARATION

- A. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade.
 - 1. Reduce elevation of planting soil to allow for soil thickness of sod.
- B. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in "Turf Area Preparation" Article.
- B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
- C. Fill cells of erosion-control mat with planting soil and compact before planting.
- D. 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.
- E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 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 **3 to 4 lb/1000 sq. ft.**
- C. Rake seed lightly into top **1/8 inch** of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with erosion-control mats where indicated on Drawings; install and anchor according to manufacturer's written instructions.

3.6 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, commercial fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
 - 1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
 - 2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than **1500-lb/acre** dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.7 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - 1. Lay sod across slopes exceeding 1:3.
 - 2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of **1-1/2 inches** below sod.

3.8 TURF RENOVATION

- A. Renovate existing turf where indicated.
- B. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
 - 1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
 - 2. Install new planting soil as required.
- C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- D. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- E. Mow, dethatch, core aerate, and rake existing turf.
- F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- H. Till stripped, bare, and compacted areas thoroughly to a soil depth of **6 inches**.
- I. Apply as required for new turf.
- J. Water newly planted areas and keep moist until new turf is established.

3.9 TURF MAINTENANCE

- A. The Contractor shall maintain turf by watering, fertilizing, weeding, mowing, trimming, as required until satisfactory turf is established.
- B. The Contractor shall 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 if directed by Owner, including:
 - 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.

3.10 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Owner's Representative:
 - 1. Satisfactory Seeded Turf: 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: 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 until turf is satisfactory.

3.11 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. 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 329200

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ITEM 637.12---25 – ENGINEER’S FIELD OFFICE – TYPE 2
ITEM 637.13---25 – ENGINEER’S FIELD OFFICE – TYPE 3
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1. **DESCRIPTION.** This work shall consist of providing, for the Engineer’s use a building, or a portion thereof, or a modular trailer of a specified type erected at a location approved by the Engineer. In addition, all computer hardware, software and internet communications described in this specification shall be provided for the duration of the contract.
2. **MATERIALS:**

- 2.01 **Engineer’s Field Office.** The Engineer’s Field Office shall be within a secured, weatherproof building or mobile trailer. If two (2) or more mobile trailer units are provided, they shall be joined with weatherproof connections. Mobile trailers shall be in new or like new condition. The Contractor may furnish equivalent facilities in an existing building, provided that the building is located to provide convenient service. The Contractor shall supply the Engineer with a copy of the Certificate of Occupancy for the existing building.

The Engineer’s Field Office shall be in accordance with the requirements of the New York State Uniform Fire Prevention and Building Code, 19 NYCRR, and any applicable local codes.

The Engineer’s Field Office shall be in a location with access to high-speed broadband (non-satellite) Internet service, as determined by the Engineer.

The electrical system shall be able to continuously operate all equipment and be provided with adequate receptacles. To accommodate computer equipment, the field office shall be provided with a dedicated 20 amp electrical service and a vacant floor-to-ceiling area with a 39 inch by 39 inch footprint along a wall for the installation of a computer hardware rack/cabinet. Electric light shall be provided by non-glare type luminaires to provide a minimum illumination level of 1,000 lux at desk-height level. An ambient air temperature of 70 °F ±10 °F shall be maintained.

Fire extinguishers and smoke and carbon monoxide detectors shall be provided and installed.

The Engineer’s Field Office shall be partitioned to provide separate rooms, defined as either “small” or “large”, with adjoining doors. Table 637-1 contains the minimum area requirements for each of the office types.

TABLE 637-1 ENGINEER’S FIELD OFFICE AREA REQUIREMENTS					
Physical Requirement	Engineer’s Field Office Type				
	1	2	3	4	5
Min. total floor area (ft ²)	540	860	1300	2475	2700
Min. number of small rooms	2	3	2	3	6
Min. floor area of each small room (ft ²)	100	100	120	150	175
Min. number of large rooms	1	1	2	2	2
Min. floor area of each large room (ft ²)	200	200	240	300	350

- A. **Potable Water.** From a local municipal water supply, certified well or bottled with a heating/refrigerator unit to provide hot and cold water. An exterior frost-free hose bib shall be

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provided in a location adjacent to the Engineer’s Field Office. The hose bib need not be installed on a potable water line, and if the water in the line is not potable, it shall be clearly marked as such.

- B. **Restroom.** A separately enclosed room, lockable from the inside, that is properly ventilated and in compliance with applicable sanitary codes. The Contractor shall provide all lavatory amenities, necessary paper and soap products, hot and cold running water and a toilet. The toilet shall be flush type where sanitary facilities are available, and a type approved by the Engineer prior to installation where sanitary facilities are not available. The minimum required number of restrooms to be provided is specified in Table 637-2.
- C. **Parking Area.** The Contractor shall provide and/or construct paved or hard surfaced (gravel or bankrun material) secure parking area with dedicated parking spaces adjacent to the Engineer’s Field Office. Each parking space shall be 9 feet by 18 feet, and the minimum required number of spaces to be provided is specified in Table 637-2.
- D. **Field Office Signs.** The sign panel material shall be aluminum, fiberglass, plywood or lightweight plastic. The sign sheeting shall be ASTM Type III. The sign panel shall be 36 inches high by 48 inches wide with white legend on green background with the phrases as positioned and described below. If erected at a location where the sign might be struck by an errant vehicle, the sign support shall be a breakaway type.

The letters in the phrase "FIELD OFFICE" shall be 6 inch C series with the top of the letters 6 inches below the top of the panel. The letters in the phrase "ENGINEER-IN-CHARGE" shall be 6 inch B series with the top of the letters 18 inches below the top of the panel. The letters in the phrase "N.Y.S. THRUWAY AUTHORITY" shall be 1½ inch E series with the top of the letters 30 inches below the top of the panel. All phrases shall be centered horizontally on the panel.

If the Engineer’s Field Office is not located within or adjacent to the contract limits, two (2) additional signs shall be displayed conspicuously within the contract limits. The signs shall be similar to the above description, except that they shall be 48 inches high by 64 inches wide and have an additional bottom line of text containing the street address of the Engineer’s Field Office. The letters in the street address shall be 6 inch B series with the top of the letters 36 inches below the top of the panel and centered horizontally on the panel.

- E. **Mailbox.** Standard mailbox (with post if necessary) or post office box meeting the requirements of the U.S. Postal Service.
- F. **Telephone and Answering System.** A separate telephone and digital answering system for the exclusive use of the inspection staff. The minimum required number of telephone voice lines to be provided is specified in Table 637-2 (these lines are in addition to the separate lines to be provided for the dial-up computer access if high speed internet access is not available where the field office is located, as determined by the Engineer). The telephone and answering system shall provide the ability to answer all voice lines from each voice line, transfer calls to all voice lines and be equipped with a single, dedicated answering system.

A minimum of one (1) telephone shall be cordless and a minimum of one (1) telephone shall be equipped with speaker and conference call capability. The remaining telephones, at least one (1) per required voice line, shall be extension telephones with minimum 25 foot long cords. The digital answering system shall be capable of recording outgoing messages up to 60 seconds long and

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- receiving a minimum of 40 incoming messages of 60 seconds duration. The system must include automated voice marking of time and day of each message received and provide a message mark so that new messages may be played back without erasing old messages. The system shall include remote programming of playback, backspace, and outgoing message re-record and allow for the retrieval of messages without a remote control unit.
- G. **Photocopier.** Heavy duty, electric, dry-process photocopying machine. The machine shall be an all-in-one copy machine with black & white and color copying, black & white and color printing and black & white and color scanning capabilities. Machine shall have at least three paper bins (8½ x 11 inches, 8½ x 14 inches and 11 x 17 inches), enlarging and reducing capabilities, and collating, sorting stapling and double-sided copying. Set-up, printer drivers, software and networking are required. All on-site staff email addresses shall be set up and programmed for ease of scanning. Maintenance shall be provided, as required, including repairs and all necessary toner cartridges and staples for the life of the contract and until final completion. One (1) case (5,000 sheets, 20 lb, white) of each paper size shall be provided as initial stock.
 - H. **Paper Shredder.** Automatic start, heavy duty cross-cut paper shredder. The shredder shall be able to receive 8½ inch wide paper and shred a minimum of 15 sheets simultaneously along with CDs and staples.
 - I. **Pencil Sharpener.** Manual or electric pencil sharpener, minimum of 1, throughout duration of the project.
 - J. **Interior Bulletin Board.** An installed, wall-mounted 4 foot by 6 foot bulletin board made of cork or similar material in a large room, and one (1) 2 foot by 4 foot wall mounted bulletin board installed per room.
 - K. **Dry Erase Board.** Installed, wall-mounted 2 foot by 4 foot dry erase boards, minimum one (1) per room.
 - L. **Storage Locker.** Metal or wood storage locker with shelves, a tumbler lock and two (2) keys for the storage of survey, GPS and testing equipment. The total locker space footprint provided shall be a minimum of 9 square feet with a minimum height of 6 feet.
 - M. **Fire Resistant Cabinet.** Fire resistant, legal size filing cabinet with locks and two (2) keys each, meeting the requirements of ANSI/UL Standard 72 for Insulated Filing Devices, Class 350-1 hour. Each office shall be provided with two (2) 2-drawer cabinets, and the required number of additional 4-drawer cabinets as specified in Table 637-2.
 - N. **Bookcase.** Self-standing, 3-shelf metal or wood bookcase, approximately 4 feet high, 4 feet wide and 1 foot deep. The minimum required number of bookcases to be provided is specified in Table 637-2.
 - O. **Wastebasket.** Minimum 7 gallon wastebasket, minimum one (1) per desk.
 - P. **Refrigerator.** Electric, top-freezer type providing a minimum storage space of 15 cubic feet for Engineer’s Field Office Types 1 and 2, and a minimum storage space of 21 cubic feet for Types 3, 4 and 5.

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- Q. **Kitchenette.** To include a minimum 1 cubic foot, 1,300 watt microwave oven, a sink with hot and cold running water with minimum dimensions of 15 inch by 15 inch by 6 inch deep, usable counter space with minimum dimensions of 5 feet long by 2 feet deep and cabinet space with minimum dimensions of 5 feet long by 1½ feet deep by 2½ feet high. If the water in the sink is not potable, it shall be clearly marked as such.
- R. **First Aid Kit.** A Type III kit in accordance with ANSI Z308.1 *Minimum Requirements for Workplace First Aid Kits*. The minimum number of first aid kits to be provided is specified in Table 637-2.
- S. **Thermometer.** A minimum-maximum thermometer displaying in degrees Fahrenheit and mounted with an external probe to give the temperature both indoors and outdoors.
- T. **Coat Rack.** A metal or wood coat rack or closet capable of holding at least 4 coats. The minimum required number of coat racks to be provided is specified in Table 637-2. A single coat rack may be provided as long as it holds the minimum number of coats as per Table 637-2.
- U. **Office Desk and Chair.** Fully assembled freestanding office desks and chairs. Each desk shall have a 5 foot long by 2½ foot wide work surface and a height of 30 inches, at least 2 lockable drawers and include an adjustable shelf approximately 1 foot wide and no less than 2½ feet long. Each desk shall also be provided with an adjustable chair with arms, 5 legs with casters and be adjustable from approximately 16 inches to 24 inches in height. Each desk shall have a dedicated electrical outlet receptacle. The required number of office desks and chairs to be provided is specified in Table 637-2.

TABLE 637-2 ENGINEER’S FIELD OFFICE FURNISHING REQUIREMENTS					
Furnishing Description	Required Number per Engineer’s Field Office Type				
	1	2	3	4	5
Restrooms	1	1	2	2	3
Parking Spaces	6	8	12	18	22
Telephone Voice Lines	2	3	4	4	5
Telephone Line for Computers (when high speed internet is unavailable)	1	1	1	1	1
Fire Resistant Cabinets (4-drawer)	2	3	4	6	8
Bookcases	5	7	10	12	16
First Aid Kits	1	1	1	2	2
Coat Racks	1	2	3	4	5
Office Desks and Chairs	4	8	12	18	22
Office/Conference Tables	2	2	3	4	5
Folding Chairs	8	10	10	12	15
Flatbed Scanner	1	1	1	1	1
Personal Computer (Hardware and Software)	2	4	6	8	8
LaserJet printer	1	2	3	3	3
Additional Software	1	1	2	2	3

ITEM 637.11---25 – ENGINEER’S FIELD OFFICE – TYPE 1
ITEM 637.12---25 – ENGINEER’S FIELD OFFICE – TYPE 2
ITEM 637.13---25 – ENGINEER’S FIELD OFFICE – TYPE 3
ITEM 637.14---25 – ENGINEER’S FIELD OFFICE – TYPE 4
ITEM 637.15---25 – ENGINEER’S FIELD OFFICE – TYPE 5

V. **Office/Conference Table.** Commercial-grade rectangular table with weather/spill resistant top a minimum of 8 feet long by 2½ feet wide by 30 inches high. The minimum required number of office/conference tables to be provided is specified in Table 637-2.

W. **Folding Chair.** Commercial-grade, folding steel chair with approximate overall dimensions of 30 inches by 19 inches wide by 21 inches deep. The minimum required number of folding chairs to be provided is specified in Table 637-2.

2.02 **Information Technology.** The minimum required number of personal computers to be provided is specified in Table 637-2. The minimum requirements for each personal computer are:

A. **Hardware** (Note: Information in yellow highlight below has been updated from previous version of special specification.)

- CPU to operate Windows 10 for Business (64-bit edition) and all other software listed in this specification;
- Optical Drive – CD-RW/DVD-RW;
- 1 TB (terabyte) minimum hard drive;
- 8 GB (gigabytes) minimum RAM;
- USB Port(s);
- 24” LCD monitor (1920 x 1080 resolution minimum);
- One (1) 1 TB (terabyte) External Hard Drive;
- Locking cabinet(s) which encloses all computer hardware;
- Surge protection device;
- External 3 button optical scroll mouse;
- External Speakers;
- Modem with separate phone line for computer (if high speed internet service is unavailable, as determined by the Engineer), (minimum 56K baud rate).
- USB Microphone and web camera for online tele-conferencing.

B. **Software.** Substitutions for the specified software shall not be permitted unless noted otherwise. All manuals shall be provided.

- Windows 10 for Business (64-bit edition);
- Microsoft Word (2016 version or later);
- Microsoft Excel (2016 version or later);
- 7-ZIP;
- Norton Internet Security (latest version for Windows 10) set up to run in Auto-Protect Mode and Auto Update Mode (monthly), or McAfee Internet Security Suite (latest version);

Note: Microsoft Office 2016 Standard Edition, or later version, may be used in lieu of Word 2016 and Excel 2016.

C. **Additional Software.** The following software shall also be provided on the number of personal computers specified in Table 637-2:

- Microsoft Photo Editor (latest version);

- ITEM 637.11---25 – ENGINEER’S FIELD OFFICE – TYPE 1**
ITEM 637.12---25 – ENGINEER’S FIELD OFFICE – TYPE 2
ITEM 637.13---25 – ENGINEER’S FIELD OFFICE – TYPE 3
ITEM 637.14---25 – ENGINEER’S FIELD OFFICE – TYPE 4
ITEM 637.15---25 – ENGINEER’S FIELD OFFICE – TYPE 5

- Adobe Acrobat XI Professional (latest version);

D. Internet Communication.

- **Cable Internet Service.** 10/100 Ethernet cable network card and high-speed cable modem capable of transferring data at a minimum of 50 megabits per second;
- Subscription to an Internet Service Provider capable of providing high-speed Internet service;
- Network/Wireless – Ethernet or wireless card to be compatible with the selected internet and office network connections.

3. **CONSTRUCTION DETAILS.** The Contractor shall be responsible, until use and occupancy is relinquished by the Authority, for any and all damage, direct or indirect, of whatever nature, occurring to the property of the Authority and property of the inspection staff which is kept in the Engineer's Field Office. The Engineer will provide the Contractor with a detailed list of items kept in the office, with corresponding dollar values, and will provide the Contractor with updates when something on the list changes. Non-Authority-owned property shall only be those items used in the performance of contract-related work activities. Such property shall be replaced within 30 days of the reported damages and would include any loss caused by, but not limited to, fire, theft, vandalism or malicious mischief. The Contractor shall not be responsible for items kept in the Engineer's Field Office that are not on this list.

The Contractor shall install the Engineer’s Field Office sign at a location approved by the Engineer. If the Engineer’s Field Office is not located within or adjacent to the contract limits, two (2) additional signs shall be displayed conspicuously within the contract limits in locations directed by the Engineer.

The Engineer’s Field Office shall be fully equipped and made available for use and occupancy by the inspection staff prior to the start of any contract work, and shall be made available after contract final acceptance as directed in writing by the Division Construction Engineer.

All furniture and equipment shall be fully assembled, operational, clean and serviceable. The Engineer’s Field Office shall be cleaned weekly or more often if required, and the timing of the cleaning operations shall be coordinated with the Engineer. The Contractor shall remove and dispose of all rubbish generated in the office and shall keep the office free from pests. The Contractor shall remove snow from all areas subject to vehicular circulation and parking.

After completion, all portable buildings or trailers, fencing, surfacing and utilities shall be removed from the location and the areas cleaned, loamed and restored as required. The Contractor shall be responsible for providing all necessary computer hardware, software and peripheral devices as well as high-speed Internet service to the Engineer’s Field Office until use and occupancy of the Engineer’s Field Office is relinquished by the Authority. Only internet services that can provide a minimum data transfer rate of 50 megabits per second will be considered acceptable. The Contractor shall be responsible for providing all necessary service connections to the Engineer’s Field Office and Engineer’s Field Office computer(s). In addition, the Contractor shall provide a cable or DSL modem and any other equipment necessary to provide the minimum specified data transfer rate.

4. **METHOD OF MEASUREMENT.** The Engineer’s Field Office will be measured for payment as the number of months satisfactorily provided, measured to the nearest 0.25 months.

ITEM 637.11----25 – ENGINEER’S FIELD OFFICE – TYPE 1
ITEM 637.12----25 – ENGINEER’S FIELD OFFICE – TYPE 2
ITEM 637.13----25 – ENGINEER’S FIELD OFFICE – TYPE 3
ITEM 637.14----25 – ENGINEER’S FIELD OFFICE – TYPE 4
ITEM 637.15----25 – ENGINEER’S FIELD OFFICE – TYPE 5

5. **BASIS OF PAYMENT.** The unit price bid per month for the Engineer’s Field Office shall include the cost of all labor, materials and equipment necessary to complete the work including property rental, utility charges and incidental expenses. Payment will be made for each month of availability for occupancy by the Engineer and inspection field staff.

No payment will be made under Engineer's Field Office when deficiencies in compliance with these requirements are not promptly addressed by the Contractor after notification by the Engineer. Should the aggregate of non-compliance days exceed 3 days in any one month, no payment shall be made for the entire month in which deficiencies were cited.

Monthly payments may be terminated prior to contract final acceptance by written notification by the Division Construction Engineer that such office will no longer be required on the contract. Payment for each month's occupancy of the Engineer’s Field Office after the date of contract final acceptance will be made as part of the final contract payment. Failure of the Contractor to supply documentation required to complete the final estimate may result in nonpayment during this delaying period.

During periods of contract extension of time where Engineering Charges are assessed, no payment will be made for occupancy and services, except that payment for each month's occupancy after the date of final acceptance will be made as part of the final estimate.

ITEM 699.04----25 - MOBILIZATION**1. DESCRIPTION:**

1.01 Under this work the Contractor shall provide the following:

- A. Necessary bonds, insurance, and prefinancing and set-up of necessary general plant, including shops, storage areas, Engineer's and Contractor's offices and such sanitary and other facilities as are required by local or state law or regulation.
- B. Critical path method (CPM) schedule of operations as described in §108-01 of the TA Addendum.
- C. M/WBE participation program meeting the M/WBE goals of the contract as described in §109-06 *Contract Payments* and in accordance with §102-12 *D/M/WBE Utilization*.

2. MATERIALS:

2.01 Unless otherwise specified, such materials as required for mobilization and are not to be part of the completed contract shall be as determined by the Contractor, except that they shall conform to any pertinent local or state law, regulation or code.

3. CONSTRUCTION DETAILS:

3.01 The work required to provide the above facilities and service for mobilization shall be done in a safe and workmanlike manner and shall conform with any pertinent local or state law, regulation or code. Good housekeeping consistent with safety and other requirements of this contract shall be maintained.

4. METHOD OF MEASUREMENT:

4.01 Payment for mobilization will be made on a lump sum basis.

5. BASIS OF PAYMENT:

5.01 The amount bid for mobilization shall not exceed four percent (4%) of the total contract bid price excluding the bid price for mobilization. Should the bidder exceed the foregoing four percent (4%), the Authority will make the necessary adjustment to determine the total amount bid based on the arithmetically correct proposal.

The amount bid shall include the furnishing and maintaining of services and facilities noted under Section 1.01 to the extent and at the time the Contractor deems them necessary for its operations, consistent with the requirements of this work and the contract.

The amount bid shall be payable to the Contractor with the first contract payment made for other contract work following acceptable completion of all requirements noted under Section 1.01.

Payment will be made under:

<u>Item Number</u>	<u>Item</u>	<u>Pay Unit</u>
699.04----25	Mobilization	Lump Sum

SPECIAL NOTES

CONFIDENTIAL INFORMATION

1. **Confidential Information:** “Confidential Information” means any information not generally known to the public, whether oral or written, that the Authority claims is confidential and discloses to Contractor for the purposes of performing work on the Project. Confidential Information may include, but is not limited to, operational and infrastructure information relating to: bid documents, plans, drawings, specifications, reports, product information and data, business and security processes and procedures; personnel and organizational data, and financial statements; information system IP addresses, passwords, security controls, architectures and designs; and such other data, information and images that the authority deems confidential. The Authority will identify written Confidential Information by marking it with the word “Confidential” and will identify oral Confidential Information as confidential at the time of disclosure to the Contractor.
2. **Exempt Materials:** Confidential Information does not include information which, at the time of the Authority disclosure to Contractor; (a) is already in the public domain or becomes publicly known through no act of Contractor; (b) is already known by Contractor free of any confidentiality obligations; (c) is information that the Authority has approved in writing for disclosure; or (d) is required to be disclosed by Contractor pursuant to law so long as Contractor provides the Authority with notice of such disclosure requirement and an opportunity to defend prior to any such disclosure.
3. **Permitted Use:** Contractor may use Confidential Information solely for the purposes of performing work on the Project. Contractor may share Confidential Information with its employees, consultants, sub-consultants, sub-contractors, suppliers, and agents that are necessary to perform work on the Project (“Authorized Personnel”), but must ensure that such Authorized Personnel execute a Confidentiality and Non-Disclosure Agreement as set forth in the Minimum requirements for the Handling and Treatment of Confidential Information. The Authority’s disclosure of Confidential Information to Contractor shall not convey to Contractor any right to or interest in such Confidential Information and the Authority shall retain all right and title to such Confidential Information at all times.
4. **Protections:** Contractor shall hold Confidential Information confidential to the maximum extent permitted by law. Contractor shall safeguard Confidential Information in accordance with the Minimum Requirements for the Handling and Treatment of Confidential Information.
5. **Return of Confidential Information:** Upon the written request of the Authority, Contractor shall return all written Confidential Information to the Authority.

EXTERNAL CONNECTIONS

If in order to perform work on the Project, Contractor must make an external connection to the Authority’s data communications infrastructure and/or access Authority information systems, Contractor shall in all respects comply with all Authority policies and procedures regarding such connections and information systems access and undertake whatever actions are necessary in the discretion of the Authority to ensure such compliance. Contractor shall be responsible for all costs associated with ensuring that its own network security measures comply with all Authority policies and procedures regarding external connections.

**MINIMUM REQUIREMENTS FOR THE
HANDLING AND TREATMENT OF CONFIDENTIAL INFORMATION**

Contractor shall meet the following minimum requirements relative to project information that is identified as **CONFIDENTIAL**.

Authorized Personnel:

Contractor shall require that all authorized individuals or entities (e.g., employees, consultants, sub-consultants, sub-contractors, suppliers and agents) ("Authorized Personnel") to which it discloses **CONFIDENTIAL** information sign a Confidentiality and Nondisclosure Agreement ("Agreement"). Such Agreement shall provide that Authorized Personnel: are personally responsible at all times for protecting **CONFIDENTIAL** information that is in their possession or control; must always use proper precautions to safeguard against the unauthorized access and disclosure of **CONFIDENTIAL** information; must notify Contractor of any known or suspected instances of loss or theft of, or unauthorized access to, **CONFIDENTIAL** information; and must return all **CONFIDENTIAL** information to Contractor upon completion of the project. Contractor shall be responsible for enforcing the provisions of such Agreement through personal observation and supervision of Authorized Personnel and utilization of appropriate processes.

Contractor shall maintain a list of all Authorized Personnel which have access to **CONFIDENTIAL** information and must provide the Authority with such list upon the Authority's request. Contractor shall update such list monthly and notify the Authority of any changes in such list.

Inventory Control:

Contractor shall create and maintain an inventory of all **CONFIDENTIAL** information that it provides to Authorized Personnel. Upon completion of the project, Contractor shall check all **CONFIDENTIAL** information returned from Authorized Personnel against the inventory. Contractor shall provide a copy of the checked inventory to the Authority.

Use and Storage:

Contractor shall implement reasonable processes during normal working hours to prohibit unauthorized individuals from gaining access to **CONFIDENTIAL** information that is within the Contractor's custody and control. At times other than normal working hours, Contractor shall store **CONFIDENTIAL** information in a secure area, such as a fire-proof safe, locked desk, cabinet or other secure storage facility, where access can be controlled. Contractor shall control the access that Authorized Personnel have to **CONFIDENTIAL** information stored in such secure areas through the use of manual or automated locks and keys. Contractor shall maintain a list of Authorized Personnel who have access to such secure areas and the specific **CONFIDENTIAL** information therein.

Reproduction:

Contractor may reproduce **CONFIDENTIAL** information only to the extent necessary to carry out contract performance. Contractor must stamp/mark all **CONFIDENTIAL** information that is reproduced with the word **CONFIDENTIAL** and protect it in the same manner as the original.

Transportation:

To the extent feasible and reasonable, Contractor shall hand deliver **CONFIDENTIAL** information with instructions that only the addressee is allowed to open or view it. Contractor may send **CONFIDENTIAL** information that cannot be hand delivered via the U.S. Postal Service or express mail services (e.g., FEDEX) provided: it is packaged and sealed in a way that does not disclose its contents or the fact that it is **CONFIDENTIAL** information, and a signature from the recipient is required.

Under no circumstances shall a transportation method be used that cannot guarantee that **CONFIDENTIAL** information is accessed only by the intended recipient.

Disposal:

Contractor shall dispose of all **CONFIDENTIAL** information, regardless of its form or format, using a destruction method that prevents its unauthorized retrieval (e.g., crosscut or micro shredding, degaussing).

Loss, Theft or Unauthorized Access:

Contractor shall provide timely notice to the Authority upon discovery of any incident involving the loss or theft of, or unauthorized access to, **CONFIDENTIAL** information.

SPECIAL NOTE:
CONTROL OF MATERIALS

The Contractor's attention is directed to the TA Addendum, Section 106 – CONTROL OF MATERIAL, available from the Authority's website at: <http://www.thruway.ny.gov/business/addendum/index.html>. The Contractor understands and agrees that some or all of the off-site inspection and approval of material such as precast concrete items, structural steel, bridge bearings, concrete structural elements and/or their components to be used on this project will be done by the New York State Department of Transportation (NYSDOT) as the Authority's agent.

The Contractor agrees to the following conditions:

1. Whenever the Contractor receives direction from the NYSDOT regarding the approval/rejection of material that direction constitutes direction by the Authority under the contract and, shall be final and accepted as such by the Contractor.
2. The Contractor will not allow off-site materials subject to inspection and approval of NYSDOT to be shipped to the project site without direct authorization from the NYSDOT.
3. At the Pre-Award Meeting or as soon as practicable, but in any case, before the Pre-Construction Conference, the Contractor will provide the following information to the Thruway Authority's Director, Office of Construction Management, for transmittal to NYSDOT to arrange off-site inspections:
 - A. The name and address of each Manufacturer of all materials, and portions thereof, requiring off-site quality assurance to be incorporated into this highway project.
 - B. The name and address of each Fabricator fabricating each steel item or any portion thereof to be incorporated into this highway project.
 - C. The name and address of each Fabricator manufacturing structural pre-cast/pre-stressed items or any portion thereof to be incorporated into this highway project.
4. The Contractor agrees that it and its Subcontractors and Suppliers will acquire all materials to be incorporated into this Thruway project **only** through Manufacturing, Batching and Fabrication facilities approved by NYSDOT.

AVAILABILITY OF ELECTRONIC BID DATA

1. SUMMARY:

The New York State Thruway Authority (NYSTA) uses Project Bids Software for electronic bidding. Project Bids is a product of the American Association of State Highway and Transportation Officials (AASHTO) that is currently used by the majority of State Departments of Transportation. It is provided free of charge and can be used on almost any Windows-compatible PC. It integrates with many existing electronic bid preparation software and has import/export capability for use with database and spreadsheet systems.

Project Bids allows bidders to receive electronic proposal bid item information from the NYSTA's internet web site and to produce both an electronic and a paper-based bid.

For additional information and downloads, see the NYSTA website at:

<http://www.nysthruway.gov/business/contractors/expedite/index.html>.

2. PARTICIPATION AND RELATIONSHIP TO PAPER DOCUMENTS:

The Authority's adoption of electronic bidding does not force any Contractor to bid electronically. Rather, participation is voluntary. If submitting a bid using infotech's Bid Express internet bidding service, no paper is required. If submitting an electronic bid on a CD, DVD or USB device delivered to the Authority in person or via a courier service, **bidders must also submit print outs that match the electronic file**. Project Bids prints a check code on every bid page that must match the check code in the computer file. As the check code changes every time the electronic file is modified, matching the codes verifies that the data on the printed bid is the same as in the electronic file. **In case of discrepancy, the printouts always prevail and are the primary legal document. Therefore, the printouts can be used to make any last-minute changes.**

3. THIRD-PARTY SOFTWARE:

The NYSTA endorses no particular product but expects all such vendors and individuals to voluntarily keep pace with changes in NYSTA specifications.

4. PROPOSAL NOTES AND CHANGES BY AMENDMENT:

Contractors are solely responsible for recognizing and properly responding to any and all special notes and circumstances printed in the Contract Proposal and any and all changes by amendment from the amendment documents and/or notices communicated to them by the NYSTA's Contracts Unit.

Amendments are posted online at: www.thruway.ny.gov/business/contractors/documents/index.shtml.

Whenever an amendment is issued, a Project Bids amendment file will also be issued and must be applied to your electronic bid. Do not bid without carefully reviewing the printed proposal and any and all changes by amendment. Proposal notes and circumstances include, but are not limited to, printed information on alternate, fixed and/or limited cost items and/or special circumstances regarding item placement and use.

SPECIAL NOTE:**REQUIREMENTS FOR CONTRACTOR'S UTILIZATION OF AREAS
OUTSIDE OF THE RIGHT-OF-WAY**

1. Before the contractor can utilize any area outside of the NYS Thruway Authority (NYSTA) Right of Way (or outside of a temporary easement obtained for the project by the NYSTA), for any work associated with this project, written approval to do so shall be obtained from the NYS Thruway Authority through the Project Engineer. The contractor's request for approval shall be in writing and the Authority shall be allowed 2 weeks to review the request and respond.
2. This requirement applies to areas such as, but not limited to: borrow areas, spoil areas, equipment and/or material storage areas, haul roads, batching areas, water points, shop areas, and all similar areas. This requirement does not apply to the Contractor's established and permanent headquarters, commercial borrow sources, commercial gravel pits, commercial quarries, and all similar areas.
3. The contractor's written request for approval shall include a letter report prepared by an Environmental Professional, acceptable to the Authority, documenting the investigation of the proposed site. The expectation is that an Environmental Professional visits the site, performs an assessment of the proposed use against all applicable environmental requirements, and then documents their findings and recommendations. The letter report shall include the following unless otherwise authorized by the Authority:
 - a) A written description of the activities the contractor wishes to perform at the proposed site, including timeframes.
 - b) Maps showing Federal and State regulated wetlands. The area proposed for use shall be depicted on each map.
 - c) A site location map which accurately shows the area proposed for use, adjacent property boundaries/owners, the location of all wetland boundaries observed, and any required erosion and sediment control measures. If present, wetlands shall be delineated in the field by the Environmental Professional with stakes and ribbon, and wetland delineation data forms shall be completed.
 - d) A written statement prepared by the Environmental Professional regarding the presence of any rare animals or plants or significant natural communities. The Environmental Professional shall use the NYSDEC Environmental Resource Mapper to make this determination. If any rare species are identified, then determine if the rare species are listed as endangered or threatened and whether the NYSDEC determines the proposed use may be harmful to the species or their habitat. If so, address to the satisfaction of the NYSDEC.
 - e) A copy of the applicable SPDES permit and any local municipal permits related to use of the site.
 - f) A listing of other Environmental Permits which were obtained by the Authority for the project. These are referenced in the contract proposal.
 - g) A completed NYSTA Property Release form. The form is available through the Project Engineer.
 - h) A plan showing all restoration work. This includes, but is not limited to, plans for grading, surface restoration details, and erosion and sediment control.
4. This requirement does not waive other provisions of the contract related to use of lands outside the Right of Way. Rather, it shall be viewed as supplementary. The following contract provisions still remain in effect:

§107-08 Protection and Restoration of Property and Landscape, Subsection B. Outside the Right of Way
 §107-10 Managing Surplus Material and Waste

COMPLIANCE WITH SPDES REGULATIONS

The Contractor is advised that the NYS Thruway Authority has evaluated Stormwater requirements for this project and has determined that coverage is not warranted under NYS Department of Environmental Conservation's SPDES General Permit for Stormwater Discharges from Construction Activity (GP-0-20-001). The Contractor shall read and understand the requirements of GP-0-20-001. In the event the Contractor's operations, e.g., clearing and grubbing, expanded staging area; will cause an increase in ground disturbance beyond the amount identified in the Contract Documents, coverage under GP-0-20-001 may be required. Prior to commencing these operations, the Contractor should immediately advise the Project Engineer, who will in turn discuss the request with the Project Designer and Division Environmental Specialist or Environmental Point of Contact.

- In the event coverage is required under GP-0-20-001 as a result of these operations, the Contractor will be required to prepare a Stormwater Pollution Prevention Plan (SWPPP) and submit a Notice of Intent (NOI) with the NYS Department of Environmental Conservation.
- In the event coverage is required under GP-0-20-001 as a result of changes made by the Authority, the Authority will be required to prepare a SWPPP and submit a NOI.

In either case, the Contractor will not be allowed to proceed until verification of coverage under GP-0-20-001 has been provided to the Project Engineer. The Contractor shall make no claim against the Authority for delays resulting from preparing a SWPPP, filing a NOI, and seeking verification of permit coverage.

SPECIAL NOTE
EMBODIED CARBON REPORTING and ENVIRONMENTAL PRODUCT DECLARATIONS (EPDs)

Projects must comply with all applicable New York State (NYS) laws and policies to reduce the embodied carbon in building and infrastructure projects, including New York State Executive Order 22 (2022).

These laws and policies require Contractors to submit Environmental Product Declarations (EPDs) for certain building and construction materials supplied to State contracts. EPDs must be Product-specific Type III (Third Party Reviewed), in adherence with ISO 14025 *Environmental Labels and Declarations*, ISO 14044 *Environmental Management – Life Cycle Assessment*, and ISO 21930 *Core Rules for Environmental Product Declarations of Construction Products and Services*. Supply Chain-specific data should be used when available.

For permanently incorporated and temporary use construction materials manufactured and supplied for projects let after December 18, 2024, the Contractor shall ensure that all available EPDs are collected and submitted for asphalt mixtures, concrete mixtures (excluding precast), glass, and steel items when the quantity supplied to the project exceeds the values listed below. Units that are given in this document may differ from units listed in pay items and therefore, the Contractor must perform the necessary quantity conversion(s).

Construction Material	Minimum Quantity for Reporting (for Transportation Projects)
Concrete mixes	200 cubic yards or more (per mix design)
Asphalt mixes	8,000 short tons or more (per mix design)
Steel i. Rebar ii. Hollow Structural Sections iii. Fabricated Steel Plate iv. Hot-Rolled Sections v. Cold-Formed & Galvanized	20,000 pounds or more for rebar (category i.), per fabrication location 15,000 pounds or more for all others (categories ii – v), per fabrication location
Glass i. Flat Glass ii. Processed Glass iii. Insulated Glazing Units	2,000 square feet or more

The Contractor is not required to develop an EPD if one has not been developed by or for the manufacturer or supplier.

For projects that are active during the State Fiscal Year (April 1 - March 31) and are expected or known to meet the minimum quantities for reporting over the duration of the entire project, the Contractor shall complete and submit a “Contractor EPD Material Reporting Form” (Excel .xlsx format). The form is available on the Thruway Authority website at <https://www.thruway.ny.gov/business/contractors/forms/index.html#contractor>. The Contractor must submit the Contractor EPD Material Reporting form and all EPD(s) collected for the project to the Authority by emailing them to CarbonReports@thruway.ny.gov, with the Contract D number in the subject line of all e-mails. Questions about completing the form can be directed to the same e-mail address.

SPECIAL NOTE**DIESEL EMISSION REDUCTION ACT (DERA) REGULATORY COMPLIANCE**

All New York State Thruway Authority (NYSTA) Contractors are made aware that Environmental Conservation Law (ECL) 19-0323 and the New York State Department of Environmental Conservation (NYSDEC) regulation 6 NYCRR Part 248 *Use of Ultra Low Sulfur Diesel (ULSD) Fuel and Best Available Retrofit Technology (BART) for Heavy Duty Vehicles* requires 100% compliance as of December 31, 2019 of all regulated heavy duty diesel vehicles working on all State awarded contracts. A link to NYSDEC's Part 248 Annual Reporting Requirements which states the current deadlines is located at: <https://dec.ny.gov/regulatory/regulations/chapter-iii>. NYSTA and its Contractors are responsible for annual reporting.

All NYSTA Contractors shall make determinations of regulatory applicability for vehicles in their inventory used on active NYSTA contracts during each reporting year. These determinations shall be based on the definition of Heavy Duty Vehicle (HDV) including on and off road diesel vehicles having gross vehicle weights in excess of 8,500 pounds, excluding vehicles that are exempt as defined in 6 NYCRR 248-1.1(b)(14). Contractors shall also quantify ULSD fuel used by regulated vehicles in active contract work during the reporting year.

An electronic copy of 6 NYCRR Part 248 can be accessed at <http://www.dec.ny.gov/regs/2492.html>. Electronic copies of the Regulated Entity Vehicle Inventory Form and the Regulated Entity and Contractors Annual Report Form can be accessed under Part 248 – Use of Ultra Low Sulfur Diesel Fuel and Best Available Retrofit Technology for Heavy Duty Vehicles at the following link: <https://www.dec.ny.gov/fs/docs/spreadsheets/248annrptfrm.xlsx>.

To allow for required reports to be submitted to NYSDEC by the regulatory deadline of November 1, each year, NYSTA Contractors shall submit DERA annual reports to NYSTA by October 1, of every year reporting the required information from the previous reporting year (i.e., all 2019/2020 information to NYSTA by October 1, 2020, etc.). The following numbered information shall be submitted:

1. Inclusion of “DERA” and calendar year being reported in subject line of email
2. Contact information including firm name, contact person, phone number and e-mail
3. Estimated annual total quantity of ULSD fuel used by covered vehicles on NYSTA contracts
4. Required Fleet information for covered vehicles on NYSTA contracts

Electronic mail submissions can be sent to dieselreport@thruway.ny.gov

SPECIAL NOTES**GREEN CONSTRUCTION REQUIREMENTS****ULTRA LOW SULFUR DIESEL FUEL**

In order to reduce diesel emissions, the Contractor shall use Ultra Low Sulfur Diesel (ULSD) fuel to operate all diesel engines used to complete the work that will operate for 10 hours or more on the contract site. ULSD fuel requirements shall apply to:

- All diesel engines/equipment.
- Stationary and mobile equipment.
- Owned, leased and rented equipment.

The hours the piece of equipment is used to complete the work is defined as the actual time the engine is running. The time may be continuous or discontinuous and includes warm-up periods idling, in traffic periods, etc.

The Contractor shall repair deficiencies when any diesel powered construction equipment is in non-compliance. When non-compliance items are identified by NYSTA/CC, the Contractor will be notified for correction within a 24-hour period.

SPECIAL NOTES**GREEN CONSTRUCTION REQUIREMENTS****CONTROLLING EXPOSURE TO DIESEL EXHAUST**

The Contractor shall exercise measures to protect “Sensitive Receptors” from the impacts of diesel exhaust fumes. Sensitive Receptors include, but are not limited to: hospitals, schools, daycare facilities, building fresh air or ventilation intakes, elderly housing or convalescent facilities. The Contractor shall ensure that diesel powered engines are located away from building air conditioners and windows.

The goal is to minimize exposure of Sensitive Receptors in close proximity to diesel exhaust, in terms of both concentration and time. In general, close proximity is defined as within 15 meters of a Sensitive Receptor. Mitigation techniques include positioning stationary equipment exhausts greater than 15 meters from Sensitive Receptors, extension of equipment exhausts through the use of flexible tubing; protecting building air intakes; and the use of moving operations.

Idling time for diesel powered equipment shall be limited to three consecutive minutes for delivery and dump trucks and all other diesel powered equipment except as follows:

- When a “mobile source” (vehicle) is forced to remain motionless because of traffic conditions or mechanical difficulties over which the operator has no control.
- When it is necessary to operate a loading, unloading or processing device.
- When the outdoor temperature is less than - 3°C (27°F).
- When the “mobile source” is being repaired.

Arrow panels and portable variable message signs shall be solar powered wherever possible or practical.

Whenever possible and practicable, the Contractor shall establish staging areas for diesel powered vehicles waiting to load or unload materials at the work site. Such areas shall be located where diesel emissions have the least impact on Sensitive Receptors and the general public.

SPECIAL NOTES**GREEN CONSTRUCTION REQUIREMENTS****DUST CONTROL**

The Contractor shall minimize dust from disturbed soil surfaces or other materials that can cause off-site damage, health hazards and traffic safety problems. Dusty conditions resulting from the Contractor's operations shall be corrected at no additional cost to the State. Buffer areas of vegetation should be left where practical. Water quality shall be considered when selecting materials for dust control. An approved dust palliative may be used in conformance with applicable conditions placed on its use. A list of acceptable dust palliatives is available at: www.nysdot.gov/divisions/engineering/technical-services/geotechnical-engineering-bureau/dust-palliatives .

For areas not subject to traffic, products and materials may be applied or placed on soil surfaces to prevent airborne migration of soil particles, including:

- Vegetative Cover –provides the most practical method of dust control.
- Mulch (including rolled erosion control products) –provides a fast, effective method of dust control.
- Spray Adhesives –Generally composed of polymers in a liquid or solid form mixed with water to form an emulsion that is sprayed on the soil surface. The mixing ratios and application rates will be in accordance with the manufacturer's recommendations for the specific soils on the site. Adhesives shall not be applied to wet soils or if there is a probability of precipitation within 48 hours.

For areas subject to traffic (traveling public or construction traffic) products and materials may be applied or placed on soil surfaces to prevent airborne migration of soil particles, including:

- Water Sprinkling – The site may be sprayed with water until the surface is wet. This is especially effective on haul roads and access routes.
- Polymer Additives –Polymers shall be mixed with water and applied to the driving surface using mixing ratios and application rates in accordance with the manufacturer's recommendations. No application of the polymer will be made if there is a probability of precipitation within 48 hours of its proposed use. Any polymers must be used in accordance with the NYSDEC issued "Conditions for Use" and "Application Instructions." This information can be obtained from the NYSDEC website.
- Barriers – Woven geotextiles or stone can be placed on the driving surface to effectively reduce dust throw and particle migration on haul roads.
- Windbreak – A silt fence or similar barrier can control air currents at horizontal intervals equal to ten times the barrier height. Preserve existing vegetation that acts as a wind barrier as much as practical.
- Wheel Washing – Mechanical or manual wet-method cleaning of on-road construction vehicle tires prior to leaving site.

SPECIAL NOTE**GENERATOR KNOWLEDGE FOR DISPOSAL OF TREATED WOOD**

The U.S. Environmental Protection Agency (EPA) and New York State Department of Environmental Conservation (NYSDEC) technique for evaluating whether a material is hazardous for toxicity is the Toxicity Characteristic Leaching Procedure (TCLP). TCLP testing of pentachlorophenol (“penta”) and creosote treated wood by the Electric Power Research Institute, Association of American Railroads, and others has conclusively demonstrated that treated wood products are not a hazardous waste. Under EPA’s and NYSDEC’s rules, such “generator knowledge” can be utilized in place of testing to determine that a waste is not hazardous. This information can be used as evidence that treated wood products can be disposed as non-hazardous waste, based on generator knowledge, in lieu of physical testing.

Generator knowledge information, obtained from the American Wood Preservers Institute (AWPI) can be viewed at their web site located at www.awpi.org . AWPI’s information comes from studies conducted by the Electric Power Research Institute (EPRI), the Washington Public Ports Association (WPPA), and the Association of American Railroads (AAR). EPRI test results are for both penta-treated and creosote-treated wood. WPPA and AAR test results are for creosote-treated wood.

NOTE: Arsenically-treated (*e.g.*, chromated copper arsenate [CCA]) wood products disposed by the end user are exempt from classification as a federal hazardous waste regardless of the TCLP results for specified constituents from any individual sample. Also, wood products treated with preservatives that contain no TCLP constituents (*e.g.*, Kodiak Preserved Wood containing Copper Dimethyldithiocarbamate) are not hazardous waste.

SPECIAL NOTES
FOREST INSECT DISEASE CONTROL

MOVEMENT OF WOOD MATERIALS FROM PROJECT SITES

Pursuant to New York State Department of Environmental Conservation (NYSDEC) Regulations, 6NYCRR, part 192.5, *Firewood Restrictions to Protect Forests from Invasive Species*, it is unlawful to transport any firewood material more than 50 miles from its point of origin to limit the spread of invasive insect species. “Firewood” shall mean all wood of any species, cut or not cut, split or not split, regardless of length which is (a) in a form and size appropriate for use as a fuel, or (b) which is destined for use as a fuel. Firewood shall not include kiln-dried dimensional lumber, wood that has been chipped to a maximum piece size that is no greater than 1-inch in two dimensions, or logs or wood being transported to sawmills or other manufacturing facilities for use in their primary operations. All Thruway Authority (TA) projects are subject to this requirement. Additional information can be found at the following link: <http://www.dec.ny.gov/regs/4079.html>

If firewood is to be moved within 50 miles of its point of origin a “Self-Issued Certificate of Origin for Transport and Possession of Untreated Firewood” must be completed. This form can be found at the following link: http://www.dec.ny.gov/docs/lands_forests_pdf/selfisscert.pdf

INVASIVE SPECIES AND QUARANTINE MATERIALS MOVEMENT

NYSDEC Regulations, 6NYCRR, part 192.6, *Quarantine Orders*, No person shall fail to comply with the provisions of any quarantine order issued by the Department pursuant to Environmental Conservation Law (ECL) section 9-1303. To the extent the provisions of section 192.5 *Firewood Restrictions to Protect Forests from Invasive Species* and such quarantine order are in conflict, the more restrictive provision shall apply. TA is under New York State and Federal ash quarantines where it is unlawful to transport any ash material outside of several counties (see quarantine maps at http://www.agriculture.ny.gov/PI/eab/emerald_ash_borer_quarantine.pdf and <http://www.dec.ny.gov/animals/47761.html>). Therefore, any parts of ash trees, including leaves, bark, stumps, limbs, branches, roots, and ash logs of any length, and firewood (see above for definition of firewood) from ANY tree species, are all considered regulated articles and must be handled properly. Tree-felling, clearing and grubbing operations at project sites may result in the contractor’s need to handle materials from ash tree species and/or firewood or chips from ANY tree species. To the greatest extent possible in areas of clearing and grubbing, ash trees should be pre-identified and marked prior to commencement of construction to promote the proper handling of these materials.

Un-infested ash materials in any form may be moved offsite, but only within the quarantine zone. Firewood from ANY tree species may never be moved more than 50 miles and never from the quarantine area, into non-quarantine areas. Transport of any wood needs the required transport certificate: http://www.dec.ny.gov/docs/lands_forests_pdf/selfisscert.pdf

Note: According to the quarantine maps, several parts of the Thruway are the boundary between the quarantine area (south) and the non-quarantine area (north). Therefore, transport of any wood material would be prohibited across the roadway from south to north, but acceptable from north to south.

Note: Any ash materials that are known or suspected to be infested with live emerald ash borer pests in any life stage must be reported immediately to the EIC and/or designee for further appropriate action and coordination with regulatory agencies.

SPECIAL NOTES
FOREST INSECT DISEASE CONTROL

Any ash materials chipped to a size no greater than 1-inch in at least two dimensions is considered safe to be transported outside the quarantine zone, but only in accordance with a Chip/Mulch Agreement and Transport Agreement received from the NYS Department of Agriculture and Markets (NYSDAM). If any regulated ash materials must be moved outside of the currently quarantined area, a certification from the NYS Department of Agriculture and Markets (NYSDAM) or USDA Animal & Plant Health Inspection Service (APHIS) must be obtained. For further information see the following links:

<http://www.dec.ny.gov/animals/47761.html>

<http://www.agriculture.ny.gov/PI/eab.html>

MARKER RELOCATION DURING CONSTRUCTION
EXISTING MILE MARKERS AND TENTH-MILE MARKERS AND DELINEATORS

All mile markers and tenth-mile markers are to be maintained during construction of this project. The Contractor will be allowed to temporarily relocate them to avoid damage to them or for constructability purposes. The mile markers and tenth-mile markers may be moved but the new location must be visible to traffic and be reasonably close to their original location. The mile markers must be returned to their original location upon completion of construction at that location. Cost for this work shall be included in the bid price for the various pay items in the contract, unless the work is specifically called for in the contract documents.

If the contract calls for replacement of existing mile markers and/or tenth-mile markers, they shall remain in place, or reset to a location reasonably close to their original location, until the new markers are installed.

SPECIAL NOTE**BIRD / BAT WASTE AWARENESS**

The Contractor should be aware that there may be bird/bat waste in the work area. The waste may contain trace amounts of metals and the fungus *Histoplasma capsulatum*. Exposure to this fungus can result in the disease histoplasmosis. Proper health and safety precautions shall be identified in the contractor's health and safety plan in accordance with section 107-05. The disposal facility that accepts the bird/bat waste may need documentation as to its composition to determine that it is non-hazardous and/or otherwise suitable for disposal at that location.

SPECIAL NOTE**ASBESTOS CONTAINING MATERIAL (ACM) WITH REMEDIATION**

Asbestos-Containing Material (ACM) is present on this project and shall require disturbing, handling and disposal by the Certified Asbestos Contractor. ACM is identified on the project at the following locations:

- Backwall Grout Pad – ACM is located within the existing grout pad between the bottom of the existing concrete deck and backwall.

The Asbestos Survey report included in the project documents details these identified ACM locations. The reported asbestos quantities are estimates and represent only an approximation for the convenience of the Contractor in estimating the overall extent of asbestos removal required. Appropriate items from Section 210 of the Standard Specification have been included for payment of the asbestos work.

Certifications: All employees involved in the removal or disturbance of any ACM shall be properly and appropriately certified in accordance with 12 NYCRR 56. This includes all individuals involved in all portions of the work including inspection, design, handling, supervision, and project/compliance air monitoring.

Work Performance: All work consisting of the removal and disposal of ACM shall be planned for and performed by the Contractor in accordance with Section 210 of NYS Department of Transportation Standard Specifications, 12 NYCRR 56, and where applicable Blanket Variance 14 (BV14)-Asbestos-Containing Non-Friable Materials on Bridges, Right-of-Way and Highways. The Contractor shall provide the Thruway Project Engineer with two (2) complete sets of record documents including chain-of-custody records, worker sign in/out sheets, proof of worker certifications, results of any daily monitoring, project monitor daily logs and visual inspection reports and any other such records as requested or as required by regulation and specifications.

When BV14 is applicable and appropriate for use, the Contractor shall note that BV14 assumes that ACM to be abated from bridges is in a non-friable state. Should this ACM be found in the field to have been made friable either by weathering/mechanical action or by the Contractor's activities during abatement, the Contractor shall handle and dispose of the material as asbestos waste and not as construction and demolition (C&D) debris.

Project/Compliance Air Monitoring: The Authority will provide a Project Monitor to monitor and provide final acceptance of the asbestos abatement project and conduct all necessary compliance air monitoring. The Contractor will need to notify the Thruway Project Engineer at least two weeks prior to the start of asbestos removal to make arrangements for project monitoring.

US CUSTOMARY FUEL PRICE ADJUSTMENT

FUEL PRICE ADJUSTMENT ¹ CONVERSION FACTORS		
MATERIAL DESCRIPTION	CONVERSION FACTOR	ITEM NUMBER ^{2,7}
Unclassified Excavation	0.35 gal/yd ³	203.02
Embankment	0.10 gal/yd ³	203.03, 620.XX
Fill	0.45 gal/yd ³	203.05, 203.06, 203.07, 203.08XX, 203.20, 203.21, 203.25
Controlled Low Strength Material	1.00 gal/yd ³	204.01, 204.02, 204.03, 204.04
Trench / Culvert / Structure Excavation	0.50 gal/yd ³	206.01, 206.0201
Bituminous Stabilized Course	1.40 gal/yd ³	302.01, 307.01
Subbase Course	1.00 gal/yd ³	304 Items
Asphalt Mixtures	2.50 gal/ton	404 Items ³ , 405.01, 406 Items ³ , 421 Items ³ , 608.020102 ³ , 619.0601 ⁴ , 624.02XXXX ^{3,4} , 633.14 ^{3,4} , 633.15 ^{3,4} , 633.16 ^{3,4}
Diamond Grinding	0.13 gal/yd ²	505 Items ³
Milling	0.10 gal/yd ²	490 Items
Cold Recycling Asphalt Concrete	0.08 gal/yd ²	416.XXXXXXRR
Portland Cement Concrete Pavement	1.00 gal/yd ³	502 Item ³ , 503.1010, 603.1011, 503.1012
Fill Type Retaining Walls	0.45 gal/yd ³	554.30XX ⁵ , 554.31 ⁵ , 554.4X ⁵
Footing Concrete & Concrete for Structures – All classes	1.00 gal/yd ³	555.0104, 555.0105, 555.05, 555.06, 555.07, 555.08, 555.09, 555.10, 555.11, 555.0011, 555.0012, 555.0021, 555.0022, 555.0031, 555.0032
Structural Approach Slabs	0.33 gal/yd ²	557.2001, 557.2002, 557.2003, 557.2009, 557.22, 557.1011, 557.1012, 557.1013, 557.1019, 557.2019
Superstructure Slabs with bottom formwork	0.25 gal/yd ²	557.01XX, 557.07, 557.30, 557.41XX, 557.1111, 557.1112, 557.1113, 557.1119, 557.13, 557.2119
Superstructure Slabs - no bottom formwork	0.15 gal/yd ²	557.05XX, 557.09, 557.43XX, 557.1211, 557.1212, 557.1213, 557.1219, 557.2219
Overlay Concrete	0.05 gal/yd ²	584.3001nn, 584.3002nn, 584.3009nn, 584.3101nn, 584.3102nn, 584.3103nn, 584.3109nn, 584.3200nn, 584.0301nn, 584.0302nn, 584.0303nn, 584.0309nn, 584.0320nn
Concrete Barrier, Type A	0.16 gal/ft	606.3001, 606.3021, 606.3031
Concrete Barrier, Type B	0.19 gal/ft	569.01, 606.3002, 606.3022, 606.3032
Concrete Barrier, Type C	0.22 gal/ft	606.3003, 606.3023, 606.3033
Concrete Barrier, Half Section	0.11 gal/ft	569.02, 569.06, 606.3004, 606.3024, 606.3034
Concrete Barrier, Single Slope	0.23 gal/ft	569.05, 569.07, 606.3041, 606.3043, 606.3044

US CUSTOMARY FUEL PRICE ADJUSTMENT

FUEL PRICE ADJUSTMENT ¹ CONVERSION FACTORS		
MATERIAL DESCRIPTION	CONVERSION FACTOR	ITEM NUMBER ^{2,7}
Concrete Barrier Texas & Wide, Single Slope	0.28 gal/ft	569.08, 606.3051, 606.3053, 606.3054
Concrete Barrier Half Section, Single Slope	0.17 gal/ft	569.04, 606.3061, 606.3063, 606.3064
Vertical Faced Concrete Parapet	0.10 gal/ft	569.03
Removal and Replacement of Structural Concrete	1.00 gal/yd ³	582.05, 582.0051
Gravel, Stone, Slag	1.00 gal/yd ³	411.01, 411.02, 411.03, 623.1X
Concrete Sidewalks and Driveways	1.00 gal/yd ³	608.01XX
Concrete Curb	0.10 gal/ft	609.04XX, 609.05XX
Topsoil	0.45 gal/yd ³	610.10, 610.11XX, 610.14XX
Turf Establishment - Performance	0.05 gal/yd ³	610.16010020

FUEL PRICE ADJUSTMENT¹ CONVERSION FACTORS**Notes:**

1. In accordance with Standard Specification §698-3.02, the index value for the fuel price adjustment is the posted price for the month of bid letting.
2. Item Number - This is the contract pay item number under which these materials are most frequently paid. Unless indicated otherwise, materials similar to those indicated under the column entitled "Material Description" are also eligible for adjustment using the factor listed for a similar material with the same pay units regardless of the actual contract pay item number.
3. Quality Adjustment Items (404/406/502/505/555/557/569/582/584/608/624) are not eligible for fuel price adjustment.
4. Fuel Price Adjustment Conversion Factor based on units of TONS of asphalt placed, not the pay units of this item.
5. Fuel Price Adjustment Conversion Factor based on units of CY of backfill paid under this item, not the pay units of this item.

Compliance Requirements and Procedures

*For Participation of
Disadvantaged/Minority/Women/Service-Disabled Veteran-Owned
Business Enterprises
and
Equal Employment Opportunity
on
NYS Thruway Authority Contracts
(DBE/MWBE/SDVOB/EEO)*

CONTRACT GOALS FOR DBE/MWBE/SDVOB PARTICIPATION

The New York State Thruway Authority herein after, ("Authority") is committed to providing and ensuring Minority-owned Business Enterprises (MBE), Women-owned Business Enterprises, (WBE) Service-Disabled Veteran-Owned Business Enterprises (SDVOB) and Disadvantaged Business Enterprises (DBE) with opportunities to participate in the Authority's contracting and procurement processes in accordance with Title 49, Part 26 of the United States Code of Federal Regulations (CFR), New York State Executive Law, Articles 15-A, 17-B, and all applicable federal and state laws, rules, regulations and Executive Orders, including but not limited to Executive Order 177 - Prohibiting State Contracts with Entities that Support Discrimination, as incorporated herein and/or contained in the NYS Department of Transportation Standard Specifications Section 102, "Bidding Requirements and Conditions" to the extent applicable to the contract.

Goal(s) have been established for this Contract/Agreement, expressed as a percentage of the total Contract/Agreement amount as follows:

Disadvantaged Business Enterprise - DBE (Federal-Aid)

Disadvantaged Business Enterprise (DBE) Participation Goal: _____%

Directories and/or Information related to the current certification status of Disadvantaged Business Enterprises can be obtained from the New York State Certified DBEs website at: <https://nysucp.newnycontracts.com>

Minority/Women-Owned Business Enterprise - MWBEs (Non Federal-Aid)

Minority Business Enterprise (MBE) Participation Goal _____ 15 %

Women's Business Enterprise (WBE) Participation Goal _____ 15 %

Directories and/or information related to the current certification status of Minority/Women Business Enterprises can be obtained from the New York State Certified MWBE website at: ny.newnycontracts.com

Service-Disabled Veteran-Owned Business Enterprise (SDVOB)

Service-Disabled Veteran-Owned Business Participation Goal _____ 6 %

Directories and/or information related to the current certification status of Service-Disabled Veteran Business Enterprises can be obtained from the New York State Certified SDVOB website at: ogs.nv.gov/veterans/

Equal Employment Opportunity

Minority _____ 0 %

Female _____ 0 %

For more information about the development of the goals, see Federal Register, Vol. 45, No. 194, at 65976-65991 (October 3, 1980) (minorities) and Federal Register, Vol. 45, No. 251 at 85750-85751 (December 30, 1980) (females). The text of these Federal Register notices can be found at Federal Register Notice: Vol. 45, No. 194, at 65976-65991 (October 3, 1980)

Training Special Provisions _____ Yes ☒ No

Training/Special Provision supplements each of the foregoing prescribed specific Equal Employment Opportunity percentage goals for utilization of minorities and women in the performance of work for the geographic location of the contract, included in this Proposal entitled "Equal Employment Opportunity (EEO) Requirements."

CHART A

GOALS FOR MINORITY PARTICIPATION

County	%	County	%	County	%
Albany	3.2	Herkimer	2.1	* Richmond	
Allegany.....	6.3	Jefferson	2.5	Rockland	22.6
Broome	1.1	* Kings		St. Lawrence	2.5
* Bronx		Lewis	2.5	Saratoga	3.2
Cattaraugus	6.3	Livingston	5.3	Schenectady	3.2
Cayuga	2.5	Madison	3.8	Schoharie	2.6
Chautauqua	6.3	Monroe	5.3	Schuyler	1.2
Chemung	2.2	Montgomery	3.2	Seneca	5.9
Chenango	1.2	Nassau	5.8	Steuben	1.2
Clinton	2.6	* New York		Suffolk	5.8
Columbia	2.6	Niagara	7.7	Sullivan	17.0
Cortland	2.5	Oneida	2.1	Tioga	1.1
Delaware	1.2	Onondaga	3.8	Tompkins	1.2
Dutchess	6.4	Ontario	5.3	Ulster	17.0
Erie	7.7	Orange	17.0	Warren	2.6
Essex	2.6	Orleans	5.3	Washington	2.6
Franklin	2.5	Oswego	3.8	Wayne	5.3
Fulton	2.6	Otsego	1.2	Westchester	22.6
Genesee	5.9	Putnam	22.6	Wyoming	6.3
Greene	2.6	* Queens		Yates	5.9
Hamilton	2.6	Rensselaer	3.2		

* The following goal ranges are applicable to the indicated trades in the Counties of Bronx, Kings, New York, Queens and Richmond.

Electricians.....	9.0 to 10.2	Bricklayers.....	13.4 to 15.5
Carpenters	27.6 to 32.0	Asbestos workers.....	22.8 to 28.0
Steam fitters	12.2 to 13.5	Roofers	6.3 to 7.5
Metal lathers.....	24.6 to 25.6	Iron workers (ornamental).....	22.4 to 23.0
Painters.....	26.0 to 28.6	Cement masons.....	23.0 to 27.0
Operating engineers	25.6 to 26.0	Glaziers.....	16.0 to 20.0
Plumbers	12.0 to 14.5	Plasterers	15.8 to 18.0
Iron workers (structural)	25.9 to 32.0	Teamsters.....	22.0 to 22.5
Elevator constructors	5.5 to 6.5	Boilermakers	13.0 to 15.5
All others		16.4 to 17.5	

GOALS FOR FEMALE PARTICIPATION

Goal _____ 6.9%

COMPLIANCE REQUIREMENTS AND PROCEDURES

It is the policy of the New York State Thruway Authority (“Authority”) to comply with the provisions of Article 15-A of the New York State Executive Law, which requires that every contract over \$25,000 will afford equality of economic opportunities for minority group members and women, the facilitation of participation by minority-owned business enterprises and women-owned business enterprises. The Authority shall establish separate goals for participation of certified minority-owned business enterprises and women-owned business enterprises on all Authority contracts where applicable.

In addition, it is the policy of the Authority to ensure participation of DBEs on Federal-Aid contracts, pursuant to the provisions of Title 49, Part 26 of the United States Code of Federal Regulations.

Article 17-B of the New York State Executive Law provides for more meaningful participation in public procurement by certified Service-Disabled Veteran-Owned Business Enterprises (“SDVOBs”); thereby further integrating such businesses into New York State’s economy. The Authority recognizes the need to promote the employment of service-disabled veterans and to ensure that certified SDVOBs have opportunities for maximum feasible participation in the performance of Authority contracts.

The Authority is further committed to providing equal training and employment opportunities to minorities and women to participate in the Authority’s contracting and procurement processes, and by ensuring nondiscrimination in accordance with Appendix A - Standard Clauses for New York State Thruway Authority Contracts, including Clause 4 – Non-Discrimination Requirements, Clause 11 - Equal Employment Opportunities for Minorities and Women, Executive Order 11246, Executive Order 177, Training/Special Provisions and/or all applicable, federal, state, laws, rules, regulations and Executive Orders.

1. GENERAL PROVISIONS

- A. The Contractor and/or all subcontractors/subconsultants, shall comply with the applicable laws, rules, regulations and provisions governed by this Contract/Agreement, in addition to any nondiscrimination or diversity practices and provisions of the Contract/Agreement at no additional cost to Authority.
- B. These provisions and requirements shall be included in all subcontracting/subconsultant contracts/agreements so that these requirements and provisions shall be binding upon all subcontractors/subconsultants, performing work under this Contract/Agreement.
- C. The Contractor/Consultant represents and warrants that, as a condition for award of the Contract, the Contractor/Consultant has submitted a Statewide Utilization Management Plan (“SUMP”) via the NYS Contract System (NYSCS) if required by Authority, which lists all proposed Subcontractors/ subconsultants including an identification of the NYS certified DBE/MWBE/SDVOB subcontractors/subconsultants/ suppliers the Contractor/Consultant intends to use to perform the Work of the Contract and to achieve the DBE/MWBE/SDVOB Contract Goals established in the Contract Documents. In addition, or alternatively, Contractor/Consultant may have submitted a request for a waiver. Prior to award of the Contract, the Authority approved Contractor’s/Consultant’s plan to achieve the DBE/MWBE/SDVOB Contract Goals established in the Contract Documents (DBE/MWBE/SDVOB Utilization Plan) to the extent the Authority did not approve Contractor’s/Consultant’s request for a waiver of part or all of the DBE/MWBE/SDVOB Contract Goals. The Authority approval of the DBE/MWBE/SDVOB Utilization Plan approves a Subcontractor/Subconsultant only for the purpose of the DBE/MWBE/SDVOB Utilization Plan.

MBE PROVISIONS FOR NON-FEDERAL AID CONTRACTS AND AGREEMENTS**2. MINORITY/WOMEN-OWNED BUSINESS ENTERPRISES (MWBEs)**

In accordance with Article 15-A of the Executive Law, including regulations promulgated thereunder, the Authority has established the Minority-Owned Business Enterprise (“MBE”) and/or Women-Owned Business Enterprise (“WBE”) participation goals for this Contract/Agreement.. Contractor shall facilitate MWBE participation for the scopes of work to be performed under this Contract/Agreement, to satisfy the participation goals, or document good faith efforts taken to fulfill the goals in a manner prescribed by the Authority in accordance with the Compliance Requirements and Procedures specified herein.

The goals are applicable to the total amount payable under any Contract/Agreement awarded from this procurement and any changes made to the Contract/Agreement.

1. The Authority establishes MWBE goals for all applicable contracts. The MWBE goals for this Contract/Agreement are located on the “Contract Goals” page of this document and can also be found in the contractors/consultants documents for this Contract/Agreement.
2. For purposes of providing meaningful participation to certified MWBEs on this Contract/Agreement and in an effort to attain the certified MWBEs contract goals identified for this Contract/Agreement, the Contractor should reference the directory of MWBEs at the following internet address: ny.newnycontracts.com.
3. The Contractor understands that only sums paid to MWBEs for the performance of a Commercially Useful Function, as that term is defined in 5 NYCRR § 140.1, may be applied towards the achievement of the applicable MWBE participation goal.

In the performance of this Contract/Agreement, the monetary value of fees, or markup percentage, charged by the MWBE shall be deemed to represent the Commercially Useful Function of the MWBE serving as a broker.

4. The Contractor agrees to provide, upon request by the Authority, documentation and/or evidence of actions taken to demonstrate “Good Faith Efforts,” in accordance with 5 NYCRR § 142.8, to provide meaningful participation by MWBEs as subcontractors and suppliers in the performance of this Contract/Agreement.

3. MWBE UTILIZATION REQUIREMENTS

The Contract’s/Agreement’s MWBE goals have been established by the Authority based on certified MWBE availability, job assignments, services to be performed and/or type of work to be performed under the Contract/Agreement.

In the performance of this Contract/Agreement, 60% of the total participation value shall be deemed to represent the Commercially Useful Function of the MWBE serving as a supplier and the mark up and/or broker’s fee shall represent the Commercially Useful Function of the MWBE serving as a broker.

- A. The Contractor shall certify that the Utilization Plan identifies all subcontractors/subconsultants reflected on Exhibit D of the Contract/Agreement.
- B. The Contractor agrees to adhere to the approved MWBE Utilization Plan in the performance of the Contract/Agreement.

- C. The Contractor further agrees that failure to submit and/or adhere to such MWBE Utilization Plan shall constitute a material breach of the terms of the Contract/Agreement. Upon the occurrence of such a material breach, the Authority shall be entitled to any remedy provided herein, including but not limited to, a finding that the Contractor is non-responsible.

Utilization Plan - All Subcontractors (TA-W1022)

4. REPORTING

The Contractor is required to submit forms TA-1023 or TA-W1059 on or before the 10th of each month, following the month being reported. Monthly reports must be submitted via email, to Compliance@thruway.ny.gov, however, during the term of the contract, the Contractor may arrange to provide such reports via a non-electronic method to the Authority by the 10th day following the end of each month during the term of the Contract/Agreement.

TA-W1023 Payments to DBE/MWBE Subcontractor Firms

5. COMPLIANCE

The Contractor will comply with any procedures and guidelines established by the Director of the Division of Minority and Women-Owned Business Enterprise (hereinafter the Director) under the authority of New York State Governor's Executive Order 8, issued August 3, 1983 (hereinafter Executive Order 8) and will comply with any rules, regulations and orders of the Director as may be promulgated pursuant to or under the authority of Executive Order 8, or other applicable law or order.

6. MWBE WAIVERS

- A. Prior to submission of a request for a partial or total waiver, Contractor shall speak to someone from the Authority's Office of Compliance for guidance.
- B. In accordance with 5 NYCRR § 142.7, a Contractor that is able to document good faith efforts to meet the goal requirements, as set forth herein, may submit a request for a partial or total waiver on Form TA-W1077, accompanied by supporting documentation. A Contractor may submit the request for waiver at the same time it submits its MWBE Utilization Plan.

Supporting documentation of good faith efforts shall include, but not be limited to:

1. Evidence of targeted and specific outreach to MWBEs;
2. Logs, written correspondence, records of telephone contacts and other information to document responses from MWBEs to the Contractor outreach;
3. Copies of advertisements for participation by MWBEs in appropriate general circulation, trade, and minority or women-oriented publications;
4. The dates of attendance at any pre-bid, pre-award, or other meetings, if any, scheduled by the Authority with MWBEs; and,

5. Information describing specific steps undertaken by the Contractor to reasonably structure the Agreement's scope of work to maximize opportunities for MWBE participation.
- C. If a request for waiver is submitted with the MWBE Utilization Plan and is not approved by the Authority at that time, the provisions of clauses (C - H) will apply.

If the documentation included with the Contractor waiver request is complete, the Authority shall evaluate the request and issue a written notice of acceptance or denial within 20 business days of receipt.
 - D. Contractor shall attempt to utilize, in good faith, certified MWBEs, during the performance of the Contract/Agreement. Requests for a partial or total waiver of established goal requirements may be made to the Authority, at time of bid/proposal submission, subsequent to award of the Contract/Agreement or at any time during the term of the Contract/Agreement, but must be made no later than prior to the submission of a request for final payment on the Contract/Agreement.
 - E. If the Authority, upon review of the MWBE Utilization Plan and Monthly MWBE Form TA-1023 – Payments to DBE/MWBE/SDVOBs, determines that Contractor is failing or refusing to comply with the Contract's/Agreement's MWBE goals and no waiver has been granted in regards to such non-compliance, the Authority may issue a notice of deficiency to the Contractor.
 - F. The Contractor must respond to the notice of deficiency within seven business days of receipt. Such response may include a request for partial or total waiver of the Contract's/Agreement's MWBE goals.
 - G. If the Contractor, after making good faith efforts, is unable to achieve the MWBE goals stated herein, the Contractor may submit a request for a waiver to the Office of Compliance. Such waiver request must be supported by evidence of the good faith efforts by the Contractor to achieve the maximum feasible MWBE participation towards the applicable MWBE goals. If the documentation included with the waiver request is complete, the Authority shall evaluate the request and issue a written notice of approval or denial within twenty (20) business days of receipt.
 - H. If the Authority, upon review of the MWBE Utilization Plan and the forms TA-W1023 or TA-W1059 as described in Section 4, or any other relevant information, determines that the Contractor is noncompliant, deficient or failing to document the good faith efforts to meet the Contract's/Agreement's MWBE goals or requirements and no waiver has been issued in regards to such non-compliance, the Authority may issue a notice of deficiency to the Contractor. The Contractor must respond to the notice of deficiency letter within seven (7) business days of receipt. Such response may include a request for partial or total waiver of the Contract's/Agreement's MWBE goals.

Waiver requests shall be sent to the Authority's Office of Compliance at Compliance@thruway.ny.gov.

Contractor Forms:

Forms are located at: thruway.ny.gov/business/contractors/forms/index.html

Questions regarding compliance with MWBE participation goals, requirements and provisions should be directed to the Authority's Office of Compliance.

7. NON-COMPLIANCE

- A. Where the Authority determines that the Contractor is not in compliance with the requirements specified herein and/or other contract requirements, refuses to comply with such requirements, or if the Contractor is found to have willfully and intentionally failed to comply with the MWBE participation goals, the Contractor may be found in breach of the contract, which may result in withholding of any mobilization pay item and monthly estimates, a delay in award of the Contract/Agreement, a finding that the Contractor is non-responsible, and/or the Authority may impose liquidated damages.
- B. Such liquidated damages shall be calculated as an amount equaling the difference between:
 - 1. All sums identified for payment to MWBEs had the Contractor achieved the contractual MWBE goals; and
 - 2. All sums actually paid to MWBEs for work performed or materials supplied under the Contract/Agreement.
- C. In the event a determination has been made by the Authority, after Contractor has been afforded due process, which requires the payment of liquidated damages, Contractor shall pay such liquidated damages to the Authority within sixty (60) days after such determination or the Authority shall have the ability to withhold such amount from Contractor unless prior to the expiration of such sixtieth day, the Contractor has filed a complaint with the Director of the Division of Minority and Women's Business Development pursuant to 5 NYCRR § 142.12, in which event the liquidated damages shall be payable or withheld from the Contractor only in the event of a determination adverse to the Contractor following the complaint process.

SERVICE-DISABLED VETERAN-OWNED BUSINESS ENTERPRISES (SDVOB)

Article 17-B of the New York State Executive Law provides for meaningful participation in public procurement by certified Service-Disabled Veteran-Owned Business Enterprises ("SDVOB"), thereby further integrating such businesses into New York State's economy. The Authority recognizes the need to ensure that certified SDVOBs have opportunities for maximum feasible participation in the performance of Authority contracts. In recognition of the service and sacrifices made by service-disabled veterans and in recognition of their economic activity in doing business in New York State, Contractor is required to foster participation of SDVOBs in the fulfillment of the requirements of the Contract/Agreement.

In accordance with Article 17-b of the Executive Law, including regulations promulgated thereunder, the Authority has established the SDVOB participation goals for this Contract/Agreement, set forth in the "Contract Goals" page of this agreement.

Contractor shall facilitate SDVOB participation for the scopes of work to be performed under this Contract/Agreement, and/or document good faith efforts taken to achieve the goals in a manner prescribed by the Authority in accordance with the Compliance Requirements and Procedures specified herein.

1. SDVOB GOALS

The goals are applicable to the total amount payable under this Contract/Agreement and any changes made to the Contract/Agreement.

1. The Authority establishes SDVOB goals for all applicable contracts/agreements. The SDVOB goals for this Contract/Agreement are located on the "Contract Goals" page of this document and can also be found in the procurement documents pertaining to this Contract/Agreement.
2. For purposes of providing meaningful participation to certified SDVOBs on this Contract/Agreement and in an effort to attain the certified SDVOB goals for this Contract/Agreement, the Contractor should reference the directory of SDVOBs at the following internet address: online.ogs.ny.gov/SDVOB/search
3. Contractor must document "Good Faith Efforts" to provide meaningful participation by SDVOBs as subcontractors or suppliers in the performance of the Contract/Agreement (see clause 4 below).

2. SDVOB UTILIZATION PLANS

A. In accordance with 9 NYCRR § 252.2(i), Bidders/Proposers are required to submit a completed SDVOB Utilization Plan on Form TA-W1022 within 10 business days of letting.

B. The Utilization Plan shall list the certified SDVOBs that the Contractor intends to use to perform work on the Contract/Agreement, a description of the work that the Contractor intends the SDVOB to perform to meet the goals on the Contract/Agreement, the estimated dollar amounts to be paid to a certified SDVOB, or, if not known, an estimate of the percentage of Contract/Agreement work the SDVOB will perform. By signing the Utilization Plan, the Contractor acknowledges that making false representations or providing information that shows a lack of good faith as part of, or in conjunction with, the submission of a Utilization Plan is prohibited by law and may result in penalties including, but not limited to, termination of a

contract for cause, loss of eligibility to submit future bids, and/or withholding of payments. Any modifications or changes to the agreed participation by SDVOBs after the award of the Contract/Agreement and during the term of the Contract/Agreement must be reported on a revised Utilization Plan and submitted to the Authority's Chief Compliance Officer for approval.

C. The Authority will review the submitted SDVOB Utilization Plan and advise the Contractor of the Authority's acceptance or issue a notice of deficiency within 20 business days of receipt.

D. If a notice of deficiency is issued, Contractor agrees that it shall respond to the notice of deficiency, within seven business days of receipt, by submitting to the Authority a written remedy in response to the notice of deficiency. If the written remedy that is submitted is not timely or is found by the Authority to be inadequate, the Authority shall notify the Contractor and direct the Contractor to submit, within five business days of notification by the Authority, a request for a partial or total waiver of SDVOB participation goals on Form TA-W1077 Contractor/Consultant Waiver Request. Failure to file the waiver request form in a timely manner may be grounds for disqualification of the bid or proposal.

E. The Authority may disqualify a Contractor's bid/proposal/letter of interest as being non responsive under the following circumstances:

- (a) If a Contractor fails to submit a SDVOB Utilization Plan;
- (b) If a Contractor fails to submit a written remedy to a notice of deficiency;
- (c) If a Contractor fails to submit a request for waiver; or
- (d) If the Authority determines that the Contractor has failed to document and/or demonstrate good faith efforts.

F. If Contractor is awarded a Contract/Agreement, Contractor certifies that it will follow the submitted SDVOB Utilization Plan for the performance of SDVOBs on the Contract/Agreement in accordance with the prescribed SDVOB compliance requirements and procedures for the Contract/Agreement goals set forth in this agreement.

G. Contractor further agrees that failure to use SDVOBs as agreed in the Utilization Plan shall constitute a material breach of the terms of the Contract/Agreement. Upon the occurrence of such a material breach, the Authority shall be entitled to any remedy provided herein, including but not limited to, a finding of Contractor non-responsibility.

3. SDVOB WAIVER

A. Prior to submission of a request for a partial or total waiver, Contractor shall speak with someone from the Authority's Office of Compliance for guidance.

B. In accordance with 9 NYCRR § 252.2(m), a Contractor that is able to document good faith efforts to meet the goal requirements, as set forth herein, may submit a request for a partial or total waiver on Form TA-W1077, accompanied by supporting documentation. A Contractor may submit the request for waiver at the same time it submits its SDVOB Utilization Plan.

If a request for waiver is submitted with the SDVOB Utilization Plan and is not approved by the Authority at that time, the provisions of clauses 2 (C), (D) & (E) will apply. If the documentation

included with the Contractor's waiver request is complete, the Authority shall evaluate the request and issue a written notice of acceptance or denial within 20 days of receipt.

C. Contractor shall attempt to utilize, in good faith, certified SDVOBs, during the performance of the Contract/Agreement. Requests for a partial or total waiver of established goal requirements may be made to the Authority, at time of bid submission, subsequent to Contract/Agreement award or at any time during the term of the Contract/Agreement, but must be made no later than prior to the submission of a request for final payment on the Contract/Agreement.

D. If the Authority, upon review of the SDVOB Utilization Plan and Monthly SDVOB Form TA-1023 Payments to DBE/MWBE/SDVOBs determines that Contractor is failing or refusing to comply with the contract goals and no waiver has been granted in regards to such non-compliance, the Authority may issue a notice of deficiency to the Contractor.

The Contractor must respond to the notice of deficiency within seven business days of receipt. Such response may include a request for partial or total waiver of the Contract/Agreement SDVOB goals.

Waiver requests shall be sent to the Authority's Office of Compliance at Compliance@thruway.ny.gov.

4. GOOD FAITH EFFORTS

In accordance with 9 NYCRR § 252.2(n), Contractor must document their good faith efforts toward utilizing SDVOBs on the Contract/Agreement. Evidence of required good faith efforts shall include, but not be limited to, the following:

- (1) Copies of solicitations to SDVOBs and any responses thereto.
- (2) Explanation of the specific reasons each SDVOB that responded to Contractor's solicitation was not selected.
- (3) Dates of any pre-bid, pre-award or other meetings attended by Contractor, if any, scheduled by the Authority with certified SDVOBs which the Authority determined were capable of fulfilling the SDVOB goals set in the Contract/Agreement.
- (4) Information describing the specific steps undertaken to reasonably structure the Contract/Agreement scope of work for the purpose of subcontracting with, or obtaining supplies from, certified SDVOBs.
- (5) Other information deemed relevant to the waiver request.

5. MONTHLY SDVOB CONTRACTOR COMPLIANCE REPORT

In accordance with 9 NYCRR § 252.2(q), Contractor is required to report Monthly SDVOB Contractor Compliance to the Authority during the term of the Contract/Agreement for the preceding month's activity, documenting progress made towards achieving the Contract/Agreement SDVOB goals.

This information must be submitted by the Contractor, using Form TA-1023 Payments to DBE/MWBE/SDVOBs available on the Authority's website, reflecting the preceding month's activities. Timely, complete and accurate forms must be submitted to

Compliance@thruway.ny.gov, by the 10th day of each month, with a courtesy copy to Thruway Project Engineer (TPE)/Engineer in Charge (EIC).

6. NON-COMPLIANCE

Where the Authority determines that the Contractor is not in compliance with the requirements specified herein and/or other contract requirements, refuses to comply with such requirements, or if the Contractor is found to have willfully and intentionally failed to comply with the SDVOB participation goals, the Contractor may be found in breach of the contract, which may result in withholding of any mobilization pay item and monthly estimates, a delay in award of the Contract/Agreement, a finding that the Contractor is non-responsible, and/or the Authority may impose other breach of contract damages.

7. BREACH OF CONTRACT AND DAMAGES

In accordance with 9 NYCRR § 252.2(s), any Contractor found to have willfully and intentionally failed to comply with the SDVOB participation goals set forth in the Contract/Agreement, shall be found to have breached the Contract/Agreement and Contractor shall pay damages equivalent to the Authority's expenses for personnel, supplies and overhead related to establishing, monitoring, and reviewing certified Service-Disabled Veteran-Owned Business Enterprise programmatic goals for the specific Contract/Agreement.

Questions regarding compliance with SDVOB participation goals should be directed to the Authority's Office of Compliance.

All forms are available at:

For Contractors: thruway.ny.gov/business/contractors/forms/index.html

For Consultants: thruway.ny.gov/business/consultants/forms/index.html

For Purchasers: thruway.ny.gov/business/consultants/forms/index.html

EQUAL EMPLOYMENT OPPORTUNITY AND REMOVAL OF INSTITUTIONAL POLICIES OR PRACTICES THAT FAIL TO ADDRESS THE HARASSMENT AND DISCRIMINATION OF INDIVIDUALS

Contractor agrees to comply with all Authority Compliance Requirements and Procedures, in accordance with the terms and conditions of Appendix A – Standard Clauses for New York State Thruway Authority Contracts including Clause 4 – Non-Discrimination Requirements and Clause 11 - Equal Employment Opportunities for Minorities and Women.

Equal Employment Opportunities for minority group members and women ("EEO") and related provisions shall be deemed supplementary to, and not in lieu of, the nondiscrimination provisions required by New York State Executive Law Article 15 (the "Human Rights Law") and other applicable federal, state, and local laws.

In the performance of this Contract/Agreement, Contractor shall demonstrate compliance with the Work Force Diversity Requirements and Procedures Regarding Equal Employment Opportunities for Minority Group Members and Women, pursuant to 5 NYCRR § 143, Executive Order 177, and all other applicable federal, state and local laws, rules and regulations.

The Contractor will be required to submit its written Policy Statement ensuring “Equal Employment Opportunity and Removal of Institutional Policies or Practices That Fail to Address the Harassment and Discrimination of Individuals,” to the Authority within 10 business days after the letting/bid opening.

During the performance of this contract, the Contractor agrees to comply with the Equal Employment Opportunity (EEO) requirements specified herein.

1. DEFINITIONS – As used in these requirements, the following definitions will apply:

A. “Covered Area” means the geographical area described in the solicitation from which this contract resulted or the geographic area within which this contract will be performed.

B. “Authority” means the New York State Thruway Authority.

C. “Executive Director” means the Executive Director of the New York State Thruway Authority, or his/her duly authorized representative.

D. “Office of Compliance” means the Thruway Authority’s Office of Compliance or his/her duly authorized representative.

E. “Employer Identification Number” means the Federal Social Security Number used on the Employer’s Quarterly Federal Tax Return, U.S. Treasury Department form 941.

F. “Minority” includes:

(i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

(ii) Hispanic (a person of Mexican, Puerto Rican, Dominican, Cuban, Central or South American descent of either Indian or Hispanic origin, regardless of race;

(iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast, Asia, the Indian Subcontinent, or the Pacific Islands); and

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification. Identification may be made by any suitable authority in the community such as an educational institution, religious organization, or a state agency).

2. NON-DISCRIMINATION CLAUSE

The Contractor will ensure equal employment opportunity by not discriminating against any applicant for employment because of race, color, religion, sex, national origin, age, disability, or marital status, regarding, (among other things) the following: upgrading, demotion, transfer, recruitment, recruitment advertising, layoff, termination, rates of pay or other forms of compensation and selection for training, including apprenticeship.

3. MINORITY AND WOMEN EMPLOYMENT GOALS

The Contractor shall make a good faith effort to ensure equal employment opportunity by taking the affirmative action’s set forth in paragraph 5A through P of these requirements. The Bidder’s/Proposer’s/Contractor’s/Consultant’s/Engineer’s success in achieving or bettering the goals set forth on the contract goals page, shall be a substantial factor in any determination of

whether the Contractor has complied with its obligation to ensure equal employment opportunity in the performance of this Contract/Agreement. The goals are expressed as percentages of the total hours of employment and training that the Contractor should reasonably be able to give to female or minority employees in a certain covered area. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract/Agreement, and in each trade. These goals were established from materials published by the NYS Department of Economic Development based on appropriate workforce, demographic or other relevant data or labor force developed by the Division of Minority & Women's Business Development utilizing the 1990 Census Data.

4. AFFIRMATIVE ACTION STEPS AND NON-FEDERAL TRAINING REQUIREMENTS

The Contractor shall implement affirmative action steps at least as extensive as the following:

A. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority and female individuals working at such sites or in such facilities.

B. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

C. Maintain a current file of the name, address, and telephone number of each minority and female off-the street applicant and minority or female referral from a union, a recruitment source, or community organization and of the action which was taken with respect to each such individual.

If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union, or if referred, not employed by the Contractor, this shall be documented in writing to the Office of Compliance and noted in the file with the reasons therefore, along with whatever additional actions the Contractor may have taken.

D. Provide immediate written notification to the Office of Compliance when the Contractor has information that the union referral process has impeded the Contractor's efforts to meet its obligation.

E. Develop on-the-job training opportunities and/or participation in training programs which expressly include minorities and women, including upgrading programs and apprenticeships and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the United States Department of Labor, the New York State Department of Labor, or the New York State Thruway Authority and appropriate for utilization on New York State Thruway Authority projects. The Contractor shall provide notice of these programs to the sources compiled under 5B. above. If the Contractor fails to develop or participate in such apprentice or training programs, its failure to meet the goal set forth herein will be presumed to be noncompliance with these requirements.

F. Disseminate the Contractor's equal employment opportunity policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its equal employment opportunity obligations, by including it in any

policy, annual and collective bargaining agreement, by publicizing it in the company newspaper, annual report, and other similar items, by specific review of the policy with all management personnel and with all minority and female at least once a year, and by posting the Contractor's equal employment opportunity policy on bulletin boards accessible to all employees at each location where work under this contract is performed.

G. Review, at least annually, the Contractor's equal employment opportunity policy and affirmative action obligations under this requirement with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decision, including specific review of these items with on-site supervisory personnel such as superintendents, general forepersons, etc., prior to the initiation of work at any job site.

A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

H. Disseminate the Contractor's equal employment opportunity policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to, and discussing the Contractor's equal employment opportunity policy with, other Contractors and subcontractors with whom the Contractor does or anticipates doing business.

I. Direct its recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above describing the openings, screening procedures, and tests to be used in the selection process.

J. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer, and vacation employment to minority and female youth both on the site and in other areas of the Contractor's workforce.

K. State in all solicitations or advertisements for employees placed by or on behalf of the Contractor that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, age, disability, or marital status.

L. Conduct, at least annually, an inventory and evaluation of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for such opportunities through appropriate training or other similar activities.

M. Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the equal employment opportunity policy and the Contractor's obligations under this requirement are being carried out.

N. Ensure that all facilities and company activities are non-segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

O. Send to each labor union or representative of workers with which the Contractor has a collective bargaining agreement or other contract or understanding, a notice advising the said labor union or workers' representative of the Contractor's commitments under this requirement

and post copies of the notice in conspicuous places available to employees and applicants for employment.

P. Conduct a review, at least annually, of all supervisors' adherence to, and performance under, the Contractor's equal employment opportunity policies and affirmative action obligations.

5. CONTRACTOR/CONSULTANT ASSOCIATIONS

Contractor is encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations. The efforts of a contractor association, joint contractor union, contractor community, or other similar group of which the Contractor is a member and participant, may be asserted as fulfilling one or more of its obligations under this requirement provided that the Contractor actively participates in the group, makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

6. TRANSFER OF MINORITY OR FEMALE EMPLOYEES

Through implementing the affirmative action's set forth above and the Contractor's other efforts to ensure equal employment opportunity, the Contractor must have made a commitment to employ minorities and women throughout the life of the contract. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be violation of the contract.

7. CREDITING NON-WORKING TRAINING HOURS TOWARD EMPLOYMENT GOALS

In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the United States Department of Labor, the New York State Department of Labor or the New York State Thruway Authority and appropriate for utilization on the New York State Thruway Authority projects.

8. REQUIRED RECORDS

A. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the Contractor's equal employment opportunity policy is being carried out and to keep records. The records shall include the names, address, telephone number, construction trade, union affiliation, if any, employee identification number when assigned, social security number, race, sex, status (e.g. mechanic, apprentice, trainee, helper or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay and locations at which the work was performed for each employee.

Records shall be maintained in an understandable and retrievable form. To the extent that records kept by the Contractor for other purposes satisfy the requirements of this paragraph, the Contractor need not maintain separate records.

B. Contractor shall submit on a monthly basis “Monthly Workforce Utilization Composite” (Form TA-W1017) to the TPE/EIC for approval and submitted electronically upon approval to Compliance@thruway.ny.gov. The report shall reflect a monthly composite of the total cumulative hours of work for the entire project workforce (including all subcontractors) from the start of the contract through the contract ending date. For the purpose of composite reporting, the employment and training hours for females and minorities shall be calculated separately. Female utilization hours (minority and non-minority) shall be counted towards female utilization and minority female utilization hours shall also be counted towards minority utilization hours.

C. All records required by this Section must be retained for a period of six years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the Authority or the Office of Compliance.

9. GOALS NOT TO BE USED TO DISCRIMINATE

The Contractor shall not use the goals or affirmative action requirements to discriminate against any person because of race, color, religion, sex, national origin, age disability, or marital status.

10. AVAILABILITY OF CONTRACTOR’S RECORDS

The Contractor will furnish all information and reports as may be required by the Authority or by rules, regulations and orders incorporated herein by the Authority and will permit access to its books, records and accounts by the Authority’s Office of Compliance for purposes of monitoring and investigating compliance with these requirements and such rules, regulations, orders, procedures and guidelines.

11. ENFORCEMENT

In order to determine whether the Contractor has complied with the requirements, the Authority may proceed by order to show cause, compliance conference, hearing or any other lawful procedure upon due notice in writing to the Contractor. In the event the Authority finds that the Contractor has failed to comply with these requirements, this contract may be canceled, terminated, or suspended in whole or in part or liquidated damages may be imposed in accordance with the procedures authorized in Section 312 of Executive Law 15-A, Section 40 of the Highway Law, provisions of this Contract/Agreement, relevant laws and statutes as deemed appropriate by the Authority, at no cost or liability to the Authority.

In accordance with EO 177 entitled “Prohibiting State Contracts with Entities that Support Discrimination”, provisions of this Contract/Agreement and Section 40 of the Highway Law, the Contractor may be declared ineligible for further New York State government contract or construction contracts, and such other sanctions may be imposed and remedies invoked as deemed appropriate by the Authority by rule, regulation, or order of the Authority, or as otherwise provided by law.

12. CONTRACTOR’S RESPONSIBILITY REGARDING COLLECTIVE BARGAINING AGREEMENT

Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement to refer either minorities or women shall excuse the Contractor’s obligations under these requirements, any rules, regulations, procedures and guidelines promulgated or established pursuant to Executive Order 21.

13. APPLICABILITY TO SUBCONTRACT

As per Section 312 of Executive Law 15-A the Contractor will physically include the document Equal Employment Opportunity Requirements as part of every subcontract or purchase order unless exempted by rules, regulations, or orders of the Director, pursuant to the Executive Order 8, and such requirements shall be binding upon each subcontractor, service provider, or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Authority may direct as a means of enforcing such provisions, including sanctions for

noncompliance; provided, however that in the event the Contractor becomes involved in or is threatened with litigation by a subcontractor or vendor as a result of any provision or direction issued pursuant to these requirements or by the Authority, the Contractor may request the State of New York to enter into such litigation or dispute to protect the interests of the State of New York.

14. EQUAL EMPLOYMENT OPPORTUNITY OFFICER

The Contractor will designate and make known to the Office of Compliance who will have the responsibility for and must be capable of effectively administering and promoting an active Contractor program of equal employment opportunity and who must be assigned adequate authority and responsibility to do so.

15. COMPLAINTS OF ALLEGED DISCRIMINATION/SEXUAL HARASSMENT

The Contractor will promptly investigate all complaints of alleged discrimination/sexual harassment made to the Contractor in connection with his/her obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination/sexual harassment may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the Contractor will inform every complainant of all of his or her avenues of appeal, including the New York State Division of Human Rights and Equal Employment Opportunity Commission.

The Contractor shall inform the Office of Compliance (within 24 hours) in writing of any formal or informal complaint, incident or any issue of discrimination/sexual harassment. Results of investigation must be submitted to the Office of Compliance within ten (10) days of the complaint.

TRAINING SPECIAL PROVISIONS

TA-1041 – Training Report

TA-1046 – Monthly Training Report

This work shall consist of the employment and meaningful and effective training of minority and women in New York State Thruway Authority approved training programs leading to their qualification as journeyworkers in the skilled trades required in highway construction. This Training/Special Provision supplements the Equal Employment Opportunity requirements included elsewhere in this Proposal entitled “Equal Employment Opportunity (EEO) Requirements”. Each of the foregoing prescribed specific percentage goals for utilization of minorities and women in the performance of work for the geographic location of the contract.

GENERAL: The primary objective of this Training/Special Provision is to provide training opportunities to minorities and women in construction trades for two purposes:

1. To maintain a pool of qualified minorities and women to replace those journeyworkers who, in the natural course of events, will leave the workforce; and
2. To provide minorities and women as indentured apprentices or trainees in those geographic areas where shortages in minorities and women journeyworkers are recognized because of the Contractor's inability to meet the EEO goals set forth in this contract.

Each contract which contains this Training/Special Provision shall require the training of at least one minority or woman indentured apprentice or trainee. Such individual shall be approved by the Authority. Other than this initial training obligation, to be undertaken and provided by the Contractor, no additional training obligations will exist under this Training/Special Provision unless the goals for minority and women employment and training in the skilled workforce are not continuously met on the contract and generally distributed amongst the trades. In the five counties of New York City, the goals specified for each trade are applicable and must be met. Whenever the goals are not met, additional minorities and/or women indentured apprentices and/or trainees will be assigned or approved in numbers necessary to meet the goals. Data necessary to determine if goals are being met will be provided on Contractor and Subcontractor Employment Utilization Reports (Form TA-1017-9). The data will be verified by the visual observance of the Project Engineer, or designated project inspectors, and hours of employment reported on Contractor or Subcontractor certified weekly payrolls.

The number of minorities and women indentured apprentices and trainees required to be trained under this item shall not exceed 12% of the total journeyworker workforce on the contract, i.e. no more than 1 in 8 of the skilled workforce is required to be a minority or woman indentured apprentice or trainee. This limitation applies regardless of minority and women representation in the trades. However, this limit on required training in no way absolves the Contractor of the responsibility to comply with the EEO requirements.

PRE-AWARD MEETING: Before the Contractor will be allowed to begin work, the Contractor shall attend a Pre-award Meeting and shall submit for Authority use and acceptance, a Workforce and Training Utilization Schedule (Form TA-1024) which shall be correlated to the Contractor's contract work schedule. The Schedule shall include at least the following information:

1. A work schedule for the entire contract,
2. An estimate of the work force required to conform to the work schedule on a monthly basis including an estimate of the workforce in each trade and/or work classification projected to be used including Subcontractors,
3. Separate estimates of the number of minorities and women indentured apprentices or trainees that would be required in each skilled trade to meet the contract EEO employment goals for that trade assuming no minorities or women journeyworkers in the workforce,
4. The proposed training programs to be used and the starting dates for training in each trade and/or work classification,
5. An estimate of the availability of minorities and women journeyworkers in numbers sufficient to meet the EEO contract goals, and

6. Any proposal by the Contractor to use trainees or indentured apprentices to make up for anticipated EEO goal shortfalls. Such proposals shall include the name and craft of any individual proposed by the Contractor as the required trainee or indentured apprentice. In the case of an indentured apprentice, evidence of indentureship and registration of the approved apprenticeship program must be included.

No contract work may be undertaken until the Authority has accepted the Workforce and Training Utilization Schedule. The Contractor shall submit a revised Workforce and Training Utilization Schedule at such times as major changes in the contract work schedule occur which substantially affect the previously submitted schedule.

RECRUITMENT: Although the training requirements of this Training/Special Provision are not intended, and shall not be used to discriminate against any applicant for training, whether a member of a protected class or not, it is recognized that non-minority males have traditionally been and continue to be trained, either formally or on-the-job in an informal manner, for work in the trades utilized in construction work. Therefore, until such time that representative numbers of minorities and women complete training and their utilization as journeyworkers is demonstrated to the extent of the participation goals as set forth in the Authority's construction contract, training required under this Training/Special Provisions will be primarily limited to minorities and women.

Thus, the Contractor shall demonstrate compliance with the intent of this Training/Special Provision by affording the Authority the opportunity to:

1. First, approve the use of a minority or woman indentured apprentice known to the Contractor through an existing Joint Apprenticeship Training program, or
2. Second, provide a partially trained minority or woman trainee who is currently enrolled in a New York State Department of Labor approved training program, or
3. Third, work cooperatively with the Contractor in recruitment of new minorities or women trainees, when needed.

In conformance with the foregoing, the Authority's Form TA-1018 (Request for Personnel), should be submitted to the TPE/EIC for submission to the Authority's Office of Compliance. The Contractor shall allow reasonable time for the Authority's Office of Compliance to ensure on-the-job orientation for approved apprentices or assigned trainees within their first month of employment.

WORK HISTORY: No individual shall be employed as a trainee in any trade and/or work classification in which such person has successfully completed a training course providing journeyworker status in the same trade or work classification, or in which such person has been gainfully employed as a journeyworker by virtue of informal on-the-job training. Detection of individuals in the above categories may be accomplished by including appropriate questions on employee application forms, inquiries to the Authority's Office of Compliance, checking personal references, or by other suitable means. Regardless of the method used, the Contractor shall document the finding for each indentured apprentice or trainee provided training under this requirement. A copy of the finding shall be given to the Authority's Office of Compliance. In the case of indentured apprentices, evidence of indentureship in a registered approved apprenticeship program shall also be submitted.

SUBCONTRACTING: In the event the Contractor subcontracts a portion of the contract work, the Contractor shall ensure the requirements of this Training/Special Provision are physically incorporated in such subcontracts to ensure the workforce utilization by the Subcontractor meets the goals for minorities and women employment and training, either independently or in combination with the prime Contractor's workforce. The Contractor must determine the hours of training, if any, and in which trade or work classification, minorities or women indentured apprentices or trainees are to be trained by the Subcontractor(s). However, the Contractor shall retain the primary responsibility for meeting the training requirements of this Training/Special Provision. Subcontractors are herewith advised that disregard of these requirements may result in the Authority either rescinding approval for work on this contract or disapproving their use on subsequent Authority contracts.

TRAINING PROGRAMS: The minimum length, type of training, and rate of pay for the trade or the work classification of the trade will be specified in the training program approved or sanctioned by the New York State Department of Labor.

Where training is to be provided under this Training/Special Provision, the Contractor shall obtain acceptance and/or approval of the training program to be used, and the starting time for training, prior to commencing training. The Contractor shall provide on-the-job training directed toward developing journeyworkers in the trade, or work classification(s) of the trade involved. To the extent the work involved on the contract permits, such training should include all phases and facets of a trade, or work classification of a trade, to satisfy usual construction industry requirements for continued or future employment therein.

It is the intent of this Training/Special Provision that training will be provided in construction trades rather than clerical type positions. Training may be permitted, in unique circumstances, in lower level management positions such as office engineers, where the training is oriented toward construction related activities. Some off-site training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of an overall training program. Both off-site and lower level management training are subject to the Authority's approval.

TRAINEE WAGES: An employee on any New York State Public Works Contract must be paid the full journeyworker prevailing wage unless such employee is individually registered in an approved and registered New York State Department of Labor Apprenticeship Program. It is the responsibility of the Contractor to ascertain the status of any employee utilized to satisfy the trainee requirements under this contract, and to ensure that all New York State Department of Labor apprenticeship requirements are met.

Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyworker wage rate on the wage determination which provides for less than full benefits for apprentices.

DURATION OF TRAINING: Once an indentured apprentice is approved or a trainee is assigned to the contract under the Training/Special Provision, that individual shall be trained in the designed trade throughout the duration of the contract whenever such trade is in use on the

contract until the trainee or apprentice has completed the approved training program. Where training is provided under a multiphase apprenticeship or training program, it is expected that training will be provided continually through all phases to the extent that opportunities for such training exist in the work under contract. Upon satisfactory completion of a phase of training under a multiphase training program, if further appropriate and required training is not available and work in the work classification of the completed phase is available, the minority or woman indentured apprentice or trainee shall continue employment, and be compensated at the prevailing journeyworker wage rate for such work. Hours of employment as a journeyworker described above will not be credited toward training hours required by the approved training or apprenticeship program.

If an indentured apprentice or trainee is terminated before completion of the contract for any reason other than seasonal lay-off or completion of work in that trade, the Contractor shall hold a counseling session with the Authority's Chief Compliance Officer and the individual to explain the reasons for termination. Documentation that the counseling session was held and the reasons for termination shall be given to the Authority's Chief Compliance Officer.

REQUIRED RECORDS: The Contractor shall provide each minority or woman trained under this provision with a certification showing the type and length of training satisfactorily completed. In addition, the Contractor shall keep records on the job site indicating the nature and hours of training provided to each trainee or indentured apprentice and furnish weekly reports documenting performance under this Training/Special Provision to the Project Engineer. No measurement will be made of training provided to indentured apprentices or trainees for whom no work history has been provided to the Project Engineer. In addition, no measurement will be made of training provided to apprentices for whom no evidence of indentureship in a registered apprenticeship program has been provided to the Project Engineer.

NO PAYMENT FOR TRAINING: No payment will be made for the training required of the Contractor under this Training/Special Provision. The required training is a labor cost which is included in the lump sum bid by the Contractor for the items of work comprising the contract.

(1) Journeyworker means a person who is capable of performing all the duties within a trade or a given work classification of a trade.

WORKFORCE UTILIZATION/GROSS WAGES REPORTING

In accordance with the requirements pursuant to Executive Order (EO) 162, Contractors must report employee workforce utilization on a monthly basis and gross wages on a quarterly basis for its company and all subcontractors in accordance with EO 162, as follows:

A. EO 162 (Monthly/Quarterly) Workforce Utilization/Gross Wages Reporting

Construction Contractors/Subcontractors are required to submit (Monthly) Workforce Utilization and (Quarterly) Workforce Utilization/Gross Wages Reports for their firm and all subcontractors.

(Monthly) Workforce Utilization/ (Quarterly) Gross Wages Reports are required to be electronically submitted to WorkforceUtilizationReportConstruction@thruway.ny.gov.

(Monthly) Workforce Utilization report for the preceding month must be submitted by the 10th of each month, for the Contractor and all subcontractors.

The (Monthly) EO 162 Workforce Utilization/Gross Wages Reporting are located on the Thruway website @ thruway.ny.gov/business/dmwbe/eo-162-monthly-construction.xls

(Quarterly) - Workforce Utilization, including Gross Wages Reports for quarterly reporting must be submitted by 10th of April, July, October and January, for the Contractor and all subcontractors.

The (Quarterly) EO 162 Workforce Utilization/Gross Wages Reporting are located on the Thruway website @ thruway.ny.gov/business/dmwbe/eo-162-quarterly-construction.xls

B. Form TA-1017 Monthly Workforce Utilization Composite Report

Form TA-1017 (Monthly) Workforce Utilization Composite report must be completed for each calendar month by the Contractor reflecting the cumulative total work hours of employment to date for the entire workforce.

Form TA-1017 (Monthly) - Workforce Utilization Composite Report, must be approved by the TPE/EIC and electronically submitted prior to the 10th of the month to Compliance@thruway.ny.gov.

Form TA-1017 (Monthly) - Workforce Utilization Composite Report is located on the Thruway website @ thruway.ny.gov/business/dmwbe/ta-w1017.xls

NONDISCRIMINATION

The Contractor shall comply with the provisions of the Human Rights Law, and all other state and federal statutory and constitutional non-discrimination provisions. The Contractor and its subcontractors shall not discriminate against any employee or applicant for employment because of race, creed (religion), color, sex, national origin, sexual orientation, military status, age, disability, predisposing genetic characteristic, marital status or domestic violence victim status, and shall also follow the requirements of the Human Rights Law with regard to non-discrimination on the basis of prior criminal conviction and prior arrest.

Questions regarding compliance with Workforce Utilization/Gross Wages Reporting should be directed to the Authority's Office of Compliance.

MOBILIZATION AND PAYMENT OF ESTIMATES/INVOICES

Processing of mobilization, estimates and/or invoices is contingent upon Contractor demonstration and/or documentation of compliance with **all** of the Authority's Disadvantaged Business/Equal Employment Opportunity/Minority/Women and Service-Disabled Veteran Owned-Business Enterprise Contract/Agreement requirements and provisions.

Forms listed herein may be revised, updated, at the Authority's sole discretion and are required during the covered period, under the reporting schedules established by the Authority.

DBE/EEO/MWBE/SDVOB forms, requirements and reporting schedules will be discussed during the pre-award meeting or by contacting the Authority's Office of Compliance.

REPORTING AND SUBMISSION SCHEDULES

Contractors are required to submit the following forms or reports by the 10th of each month, for the preceding month's activities to: Compliance@thruway.ny.gov

TA-W1017 Monthly Workforce Utilization Composite
TA-W1023 Payments to D/M/WBE Subcontracting Firms
TA-1024 Workforce and Training Utilization Schedule
TA-W1046-9 Weekly Training Progress Report

The above forms or reports must accurately reflect the information reported on the following forms:

TA-W1022-9 Utilization Plan
TA-W1024-9 Workforce and Training Utilization Schedule
TA-W1041-9 Training Report
TA-W1064-9 Construction Contractors Annual EEO Report

Contractors are also required to submit the following forms or reports by the 10th of each month, for the preceding month's activities to:

WorkforceUtilizationReportConstruction@thruway.ny.gov

EO 162 - Monthly Workforce Utilization/Gross Wage Report
EO 162 - Workforce Utilization/Quarterly Gross Wage Report

All Authority Forms are available at:

<http://www.thruway.ny.gov/business/contractors/forms/index.html>

Timely, complete and accurate reports shall be submitted as required and/or upon request.

STATE WAGE RATE INFORMATION

WAGE RATES

The New York State Thruway Authority does not represent or warrant that the accompanying schedule of wages with the classification of workmen, mechanics and laborers, as required by Section 220 of the Labor Law, is complete and it reserves the right to revise such schedule when required.

In the event that revisions are made before the letting date, an amendment will be issued by the Department of purchasers of plans. In the event that the current wage rate schedule should expire before the contract for this project becomes effective the said wage rate schedule will be recertified and the Contractor will be bound by such revised schedule as recertified.

Labor classifications not appearing on this rate sheet can be used only with the consent of the Chief Engineer of the Authority and then the rate to be paid will be given by the Chief Engineer of the Authority after consulting with the State Department of Labor.

All requests for minimum wage rates for additional occupations shall be directed through the Chief Engineer, Thruway Authority.

By legislation effective August 9, 1975, if the prevailing rate of wages or the prevailing practices for supplements as determined by the State Labor Department changes after the contract is let, the Thruway Authority shall request of the State Labor Department a redetermination of the schedules of wages and supplements and such revised wage rates and supplements shall be annexed to and form a part of the contract for the work. The prevailing wage rates and supplemental benefits to be paid are those in effect at the time the work is being performed. The bidder shall take into account in his bid prices all changes in wage rates and supplements that may be forthcoming during the time the contract is in force.

The bidder shall take into account in his bid prices all changes in wage rates and supplements that may be forthcoming during the time the contract is in force.

Pursuant to Section 220-A of the New York State Labor law, the prime Contractor must provide each approved subcontractor with a copy of the schedule of wages and any supplements as specified in this Contract.

The prime Contractor must immediately obtain from each approved subcontractor a certification (TA-44105) of their receipt of, and agreement to pay the applicable prevailing wages as specified in this contract. The prime Contractor shall retain all Subcontractor certifications and provide these certifications to the Authority prior to the processing of the final payment.

The prime Contractor must submit an affidavit (TA-44115) verifying the proper payment of wages to its own employees prior to the processing of the final payment. All completed certifications and affidavits must be originals and be properly signed and notarized.

SPECIAL NOTICE TO BIDDERS IN RELATION TO OVERTIME DISPENSATION

All bidders, in submitting their bids, should base their bids and work progression on the assumption that Overtime Dispensation pursuant to Article 8 of the New York State Labor Law, for any workmen, laborers and mechanics to work more than 8 hours in any one calendar day or more than five days in any one week will not be granted for any operation for the contract duration. Subsequent to award, where the contract documents have imposed specific scheduling and/or phasing requirements or where it is determined by the Authority to be in the best interest of the public, the Authority may process, for approval by the New York State Department of Labor, requests for Overtime Dispensation on certain specific operations and, in the event approval is granted, there shall be no adjustments therefore in any bid prices.

**SPECIAL NOTE
STATE PREVAILING WAGE RATES**

The Contractor shall ensure that workers are paid the appropriate wages and supplemental (fringe) benefits. Throughout the contract, the Contractor shall obtain and pay workers in accordance with periodic wage rate schedule updates from the NYS Department of Labor (NYSDOL). Wage rate amendments and supplements are available on the NYSDOL web site at <https://dol.ny.gov/bureau-public-work-and-prevailing-wage-enforcement>. All changes or clarification of labor classification(s) and applicability of prevailing wage rates shall be obtained in writing from the Office of the Director, NYSDOL Bureau of Public Work.

The NYSDOL prevailing wage rate schedule for this contract has been determined and is available on the internet. The prevailing wage rate schedule is accessed by visiting the NYSDOL web site, navigating to the appropriate web page, and entering the Prevailing Rate Case No. (PRC#). The PRC# is provided on NYSDOL Form PW-200 included in this contract Proposal.

A copy of the project specific prevailing wage rate schedule will be provided to the successful bidder upon award of the contract. Upon written request, the schedule will be provided by the Thruway Authority to prospective bidders without internet access.

The Thruway Authority is providing information regarding the new Public Work Contractor and Subcontractor Registry requirement recently enacted by New York State.

Starting December 30, 2024, all contractors and subcontractors submitting bids or performing construction work on public work projects or private projects covered by [Article 8 of the Labor Law](#) are required to register with the New York State Department of Labor (NYSDOL) under [Labor Law Section 220-i](#).

Private projects subject to Article 8 of the Labor Law include those covered by Labor Law Sections 224-a (public subsidy funded projects), 224-d (renewable energy systems), 224-e (broadband projects), 224-f (climate risk-related and energy transition projects and roadway excavations.)

The law defines a “contractor” as any entity entering into a contract to perform construction, demolition, reconstruction, excavation, rehabilitation, repair, installation, renovation, alteration or custom fabrication. The law defines “subcontractor” as any entity subcontracting with a contractor to perform construction, demolition, reconstruction, excavation, rehabilitation, repair, installation, renovation, alteration or custom fabrication, which is subject to Article 8 of the Labor Law. Contractors are responsible for verifying that any subcontractors they work with are registered.

Contractors need to register before submitting any new bids or commencing new work on a covered project on or after December 30, 2024. Subcontractors also need to register before commencing new work on a covered project on or after December 30, 2024. The Thruway Authority encourages all contractors and subcontractors to register as soon as possible and obtain a Certificate of Registration to avoid negatively impacting a bidding period or project schedule.

Information required to register from the New York State Department of Labor's website for this process can be found here: <https://dol.ny.gov/contractor-and-subcontractor-landing>. For any further questions you can also contact the Bureau of Public Work and Prevailing Wage at 518-457-5589.



Kathy Hochul, Governor

Roberta Reardon, Commissioner

NYS Thruway Authority

John McCool, Construction Specialist 1
200 Southern Blvd.
Albany NY 12209

Schedule Year 2024 through 2025
Date Requested 02/26/2025
PRC# 2025002322

Location MP340.2
Project ID# D215012
Project Type Manchester Maintenance Section - Building Addition and Roof Replacement, Milepost 340.2

PREVAILING WAGE SCHEDULE FOR ARTICLE 8 PUBLIC WORK PROJECT

Attached is the current schedule(s) of the prevailing wage rates and prevailing hourly supplements for the project referenced above. A unique Prevailing Rate Case Number (PRC#) has been assigned to the schedule(s) for your project.

The schedule is effective from July 2024 through June 2025. All updates, corrections, posted on the 1st business day of each month, and future copies of the annual determination are available on the Department's website www.labor.ny.gov. Updated PDF copies of your schedule can be accessed by entering your assigned PRC# at the proper location on the website.

It is the responsibility of the contracting agency or its agent to annex and make part, the attached schedule, to the specifications for this project, when it is advertised for bids and /or to forward said schedules to the successful bidder(s), immediately upon receipt, in order to insure the proper payment of wages.

Please refer to the "General Provisions of Laws Covering Workers on Public Work Contracts" provided with this schedule, for the specific details relating to other responsibilities of the Department of Jurisdiction.

Upon completion or cancellation of this project, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

NOTICE OF COMPLETION / CANCELLATION OF PROJECT

Date Completed: _____ Date Cancelled: _____

Name & Title of Representative: _____

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12240

General Provisions of Laws Covering Workers on Article 8 Public Work Contracts

Introduction

The Labor Law requires public work contractors and subcontractors to pay laborers, workers, or mechanics employed in the performance of a public work contract not less than the prevailing rate of wage and supplements (fringe benefits) in the locality where the work is performed.

Responsibilities of the Department of Jurisdiction

A Department of Jurisdiction (Contracting Agency) includes a state department, agency, board or commission; a county, city, town or village; a school district, board of education or board of cooperative educational services; a sewer, water, fire, improvement and other district corporation; a public benefit corporation; and a public authority awarding a public work contract.

The Department of Jurisdiction (Contracting Agency) awarding a public work contract **MUST** obtain a Prevailing Rate Schedule listing the hourly rates of wages and supplements due the workers to be employed on a public work project. This schedule may be obtained by completing and forwarding a "Request for wage and Supplement Information" form (PW 39) to the Bureau of Public Work. The Prevailing Rate Schedule **MUST** be included in the specifications for the contract to be awarded and is deemed part of the public work contract.

Upon the awarding of the contract, the law requires that the Department of Jurisdiction (Contracting Agency) furnish the following information to the Bureau: the name and address of the contractor, the date the contract was let and the approximate dollar value of the contract. To facilitate compliance with this provision of the Labor Law, a copy of the Department's "Notice of Contract Award" form (PW 16) is provided with the original Prevailing Rate Schedule.

The Department of Jurisdiction (Contracting Agency) is required to notify the Bureau of the completion or cancellation of any public work project. The Department's PW 200 form is provided for that purpose.

Both the PW 16 and PW 200 forms are available for completion [online](#).

Hours

No laborer, worker, or mechanic in the employ of a contractor or subcontractor engaged in the performance of any public work project shall be permitted to work more than eight hours in any day or more than five days in any week, except in cases of extraordinary emergency. The contractor and the Department of Jurisdiction (Contracting Agency) may apply to the Bureau of Public Work for a dispensation permitting workers to work additional hours or days per week on a particular public work project.

Wages and Supplements

The wages and supplements to be paid and/or provided to laborers, workers, and mechanics employed on a public work project shall be not less than those listed in the current Prevailing Rate Schedule for the locality where the work is performed. If a prime contractor on a public work project has not been provided with a Prevailing Rate Schedule, the contractor must notify the Department of Jurisdiction (Contracting Agency) who in turn must request an original Prevailing Rate Schedule from the Bureau of Public Work. Requests may be submitted by: mail to NYSDOL, Bureau of Public Work, State Office Bldg. Campus, Bldg. 12, Rm. 130, Albany, NY 12226; Fax to Bureau of Public Work (518) 485-1870; or electronically at the NYSDOL website www.labor.ny.gov.

Upon receiving the original schedule, the Department of Jurisdiction (Contracting Agency) is **REQUIRED** to provide complete copies to all prime contractors who in turn **MUST**, by law, provide copies of all applicable county schedules to each subcontractor and obtain from each subcontractor, an affidavit certifying such schedules were received. If the original schedule expired, the contractor may obtain a copy of the new annual determination from the NYSDOL website www.labor.ny.gov.

The Commissioner of Labor makes an annual determination of the prevailing rates. This determination is in effect from July 1st through June 30th of the following year. The annual determination is available on the NYSDOL website www.labor.ny.gov.

Payrolls and Payroll Records

Every contractor and subcontractor **MUST** keep original payrolls or transcripts subscribed and affirmed as true under penalty of perjury. As per Article 6 of the Labor law, contractors and subcontractors are required to establish, maintain, and preserve for not less than six (6) years, contemporaneous, true, and accurate payroll records. At a minimum, payrolls must show the following information for each person employed on a public work project: Name, Address, Last 4 Digits of Social Security Number, Classification(s) in which the worker was employed, Hourly wage rate(s) paid, Supplements paid or provided, and Daily and weekly number of hours worked in each classification.

The filing of payrolls to the Department of Jurisdiction is a condition of payment. Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury. The Department of Jurisdiction (Contracting Agency) shall collect, review for facial validity, and maintain such payrolls.

In addition, the Commissioner of Labor may require contractors to furnish, with ten (10) days of a request, payroll records sworn to as their validity and accuracy for public work and private work. Payroll records include, but are not limited to time cards, work description sheets, proof that supplements were provided, cancelled payroll checks and payrolls. Failure to provide the requested information within the allotted ten (10) days will result in the withholding of up to 25% of the contract, not to exceed \$100,000.00. If the contractor or subcontractor does not maintain a place of business in New York State and the amount of the contract exceeds \$25,000.00, payroll records and certifications must be kept on the project worksite.

The prime contractor is responsible for any underpayments of prevailing wages or supplements by any subcontractor.

All contractors or their subcontractors shall provide to their subcontractors a copy of the Prevailing Rate Schedule specified in the public work contract as well as any subsequently issued schedules. A failure to provide these schedules by a contractor or subcontractor is a violation of Article 8, Section 220-a of the Labor Law.

All subcontractors engaged by a public work project contractor or its subcontractor, upon receipt of the original schedule and any subsequently issued schedules, shall provide to such contractor a verified statement attesting that the subcontractor has received the Prevailing Rate Schedule and will pay or provide the applicable rates of wages and supplements specified therein. (See NYS Labor Laws, Article 8 . Section 220-a).

Determination of Prevailing Wage and Supplement Rate Updates Applicable to All Counties

The wages and supplements contained in the annual determination become effective July 1st whether or not the new determination has been received by a given contractor. Care should be taken to review the rates for obvious errors. Any corrections should be brought to the Department's attention immediately. It is the responsibility of the public work contractor to use the proper rates. If there is a question on the proper classification to be used, please call the district office located nearest the project. Any errors in the annual determination will be corrected and posted to the NYSDOL website on the first business day of each month. Contractors are responsible for paying these updated rates as well, retroactive to July 1st.

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. To the extent possible, the Department posts rates in its possession that cover periods of time beyond the July 1st to June 30th time frame covered by a particular annual determination. Rates that extend beyond that instant time period are informational ONLY and may be updated in future annual determinations that actually cover the then appropriate July 1st to June 30th time period.

Withholding of Payments

When a complaint is filed with the Commissioner of Labor alleging the failure of a contractor or subcontractor to pay or provide the prevailing wages or supplements, or when the Commissioner of Labor believes that unpaid wages or supplements may be due, payments on the public work contract shall be withheld from the prime contractor in a sufficient amount to satisfy the alleged unpaid wages and supplements, including interest and civil penalty, pending a final determination.

When the Bureau of Public Work finds that a contractor or subcontractor on a public work project failed to pay or provide the requisite prevailing wages or supplements, the Bureau is authorized by Sections 220-b and 235.2 of the Labor Law to so notify the financial officer of the Department of Jurisdiction (Contracting Agency) that awarded the public work contract. Such officer MUST then withhold or cause to be withheld from any payment due the prime contractor on account of such contract the amount indicated by the Bureau as sufficient to satisfy the unpaid wages and supplements, including interest and any civil penalty that may be assessed by the Commissioner of Labor. The withholding continues until there is a final determination of the underpayment by the Commissioner of Labor or by the court in the event a legal proceeding is instituted for review of the determination of the Commissioner of Labor.

The Department of Jurisdiction (Contracting Agency) shall comply with this order of the Commissioner of Labor or of the court with respect to the release of the funds so withheld.

Summary of Notice Posting Requirements

The current Prevailing Rate Schedule must be posted in a prominent and accessible place on the site of the public work project. The prevailing wage schedule must be encased in, or constructed of, materials capable of withstanding adverse weather conditions and be titled "PREVAILING RATE OF WAGES" in letters no smaller than two (2) inches by two (2) inches.

The ["Public Work Project"](#) notice must be posted at the beginning of the performance of every public work contract, on each job site.

Every employer providing workers. compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers. Compensation Board in a conspicuous place on the jobsite.

Every employer subject to the NYS Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers, notices furnished by the State Division of Human Rights.

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the NYS Department of Labor.

Apprentices

Employees cannot be paid apprentice rates unless they are individually registered in a program registered with the NYS Commissioner of Labor. The allowable ratio of apprentices to journeyworkers in any craft classification can be no greater than the statewide building trade ratios promulgated by the Department of Labor and included with the Prevailing Rate Schedule. An employee listed on a payroll as an apprentice who is not registered as above or is performing work outside the classification of work for which the apprentice is indentured, must be paid the prevailing journeyworker's wage rate for the classification of work the employee is actually performing.

NYSDOL Labor Law, Article 8, Section 220-3, require that only apprentices individually registered with the NYS Department of Labor may be paid apprenticeship rates on a public work project. No other Federal or State Agency of office registers apprentices in New York State.

Persons wishing to verify the apprentice registration of any person must do so in writing by mail, to the NYSDOL Office of Employability Development / Apprenticeship Training, State Office Bldg. Campus, Bldg. 12, Albany, NY 12226 or by Fax to NYSDOL Apprenticeship Training (518) 457-7154. All requests for verification must include the name and social security number of the person for whom the information is requested.

The only conclusive proof of individual apprentice registration is written verification from the NYSDOL Apprenticeship Training Albany Central office. Neither Federal nor State Apprenticeship Training offices outside of Albany can provide conclusive registration information.

It should be noted that the existence of a registered apprenticeship program is not conclusive proof that any person is registered in that program. Furthermore, the existence or possession of wallet cards, identification cards, or copies of state forms is not conclusive proof of the registration of any person as an apprentice.

Interest and Penalties

In the event that an underpayment of wages and/or supplements is found:

- Interest shall be assessed at the rate then in effect as prescribed by the Superintendent of Banks pursuant to section 14-a of the Banking Law, per annum from the date of underpayment to the date restitution is made.
- A Civil Penalty may also be assessed, not to exceed 25% of the total of wages, supplements, and interest due.

Debarment

Any contractor or subcontractor and/or its successor shall be ineligible to submit a bid on or be awarded any public work contract or subcontract with any state, municipal corporation or public body for a period of five (5) years when:

- Two (2) willful determinations have been rendered against that contractor or subcontractor and/or its successor within any consecutive six (6) year period.
- There is any willful determination that involves the falsification of payroll records or the kickback of wages or supplements.

Criminal Sanctions

Willful violations of the Prevailing Wage Law (Article 8 of the Labor Law) may be a felony punishable by fine or imprisonment of up to 15 years, or both.

Discrimination

No employee or applicant for employment may be discriminated against on account of age, race, creed, color, national origin, sex, disability or marital status.

No contractor, subcontractor nor any person acting on its behalf, shall by reason of race, creed, color, disability, sex or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates (NYS Labor Law, Article 8, Section 220-e(a)).

No contractor, subcontractor, nor any person acting on its behalf, shall in any manner, discriminate against or intimidate any employee on account of race, creed, color, disability, sex, or national origin (NYS Labor Law, Article 8, Section 220-e(b)).

The Human Rights Law also prohibits discrimination in employment because of age, marital status, or religion.

There may be deducted from the amount payable to the contractor under the contract a penalty of \$50.00 for each calendar day during which such person was discriminated against or intimidated in violation of the provision of the contract (NYS Labor Law, Article 8, Section 220-e(c)).

The contract may be cancelled or terminated by the State or municipality. All monies due or to become due thereunder may be forfeited for a second or any subsequent violation of the terms or conditions of the anti-discrimination sections of the contract (NYS Labor Law, Article 8, Section 220-e(d)).

Every employer subject to the New York State Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers notices furnished by the State Division of Human Rights.

Workers' Compensation

In accordance with Section 142 of the State Finance Law, the contractor shall maintain coverage during the life of the contract for the benefit of such employees as required by the provisions of the New York State Workers' Compensation Law.

A contractor who is awarded a public work contract must provide proof of workers' compensation coverage prior to being allowed to begin work.

The insurance policy must be issued by a company authorized to provide workers' compensation coverage in New York State. Proof of coverage must be on form C-105.2 (Certificate of Workers' Compensation Insurance) and must name this agency as a certificate holder.

If New York State coverage is added to an existing out-of-state policy, it can only be added to a policy from a company authorized to write workers' compensation coverage in this state. The coverage must be listed under item 3A of the information page.

The contractor must maintain proof that subcontractors doing work covered under this contract secured and maintained a workers' compensation policy for all employees working in New York State.

Every employer providing worker's compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers' Compensation Board in a conspicuous place on the jobsite.

Unemployment Insurance

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the New York State Department of Labor.



Kathy Hochul, Governor

Roberta Reardon, Commissioner

NYS Thruway Authority

John McCool, Construction Specialist 1
200 Southern Blvd.
Albany NY 12209

Schedule Year 2024 through 2025
Date Requested 02/26/2025
PRC# 2025002322

Location MP340.2
Project ID# D215012
Project Type Manchester Maintenance Section - Building Addition and Roof Replacement, Milepost 340.2

Notice of Contract Award

New York State Labor Law, Article 8, Section 220.3a requires that certain information regarding the awarding of public work contracts, be furnished to the Commissioner of Labor. One "Notice of Contract Award" (PW 16, which may be photocopied), **MUST** be completed for **EACH** prime contractor on the above referenced project.

Upon notifying the successful bidder(s) of this contract, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

Contractor Information

All information must be supplied

Federal Employer Identification Number: _____		
Name: _____		
Address: _____ _____		
City: _____	State: _____	Zip: _____
Amount of Contract: \$ _____	Contract Type:	
Approximate Starting Date: ____/____/____	☐ (01) General Construction	
Approximate Completion Date: ____/____/____	☐ (02) Heating/Ventilation	
	☐ (03) Electrical	
	☐ (04) Plumbing	
	☐ (05) Other : _____	

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12226

Social Security Numbers on Certified Payrolls:

The Department of Labor is cognizant of the concerns of the potential for misuse or inadvertent disclosure of social security numbers. Identity theft is a growing problem and we are sympathetic to contractors' concern regarding inclusion of this information on payrolls if another identifier will suffice.

For these reasons, the substitution of the use of the last four digits of the social security number on certified payrolls submitted to contracting agencies on public work projects is now acceptable to the Department of Labor. This change does not affect the Department's ability to request and receive the entire social security number from employers during its public work/ prevailing wage investigations.

Construction Industry Fair Play Act: Required Posting for Labor Law Article 25-B § 861-d

Construction industry employers must post the "Construction Industry Fair Play Act" notice in a prominent and accessible place on the job site. Failure to post the notice can result in penalties of up to \$1,500 for a first offense and up to \$5,000 for a second offense. The posting is included as part of this wage schedule. Additional copies may be obtained from the NYS DOL website, <https://dol.ny.gov/public-work-and-prevailing-wage>

If you have any questions concerning the Fair Play Act, please call the State Labor Department toll-free at 1-866-435-1499 or email us at: dol.misclassified@labor.ny.gov.

Worker Notification: (Labor Law §220, paragraph a of subdivision 3-a)

Effective June 23, 2020

This provision is an addition to the existing wage rate law, Labor Law §220, paragraph a of subdivision 3-a. It requires contractors and subcontractors to provide written notice to all laborers, workers or mechanics of the *prevailing wage and supplement rate* for their particular job classification *on each pay stub**. It also requires contractors and subcontractors to *post a notice* at the beginning of the performance of every public work contract *on each job site* that includes the telephone number and address for the Department of Labor and a statement informing laborers, workers or mechanics of their right to contact the Department of Labor if he/she is not receiving the proper prevailing rate of wages and/or supplements for his/her job classification. The required notification will be provided with each wage schedule, may be downloaded from our website www.labor.ny.gov or be made available upon request by contacting the Bureau of Public Work at 518-457-5589. *In the event the required information will not fit on the pay stub, an accompanying sheet or attachment of the information will suffice.

(12.20)

**To all State Departments, Agency Heads and Public Benefit Corporations
IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND**

Budget Policy & Reporting Manual

B-610

Public Work Enforcement Fund

effective date December 7, 2005

1. Purpose and Scope:

This Item describes the Public Work Enforcement Fund (the Fund, PWEF) and its relevance to State agencies and public benefit corporations engaged in construction or reconstruction contracts, maintenance and repair, and announces the recently-enacted increase to the percentage of the dollar value of such contracts that must be deposited into the Fund. This item also describes the roles of the following entities with respect to the Fund:

- New York State Department of Labor (DOL),
- The Office of the State of Comptroller (OSC), and
- State agencies and public benefit corporations.

2. Background and Statutory References:

DOL uses the Fund to enforce the State's Labor Law as it relates to contracts for construction or reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law. State agencies and public benefit corporations participating in such contracts are required to make payments to the Fund.

Chapter 511 of the Laws of 1995 (as amended by Chapter 513 of the Laws of 1997, Chapter 655 of the Laws of 1999, Chapter 376 of the Laws of 2003 and Chapter 407 of the Laws of 2005) established the Fund.

3. Procedures and Agency Responsibilities:

The Fund is supported by transfers and deposits based on the value of contracts for construction and reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law, into which all State agencies and public benefit corporations enter.

Chapter 407 of the Laws of 2005 increased the amount required to be provided to this fund to .10 of one-percent of the total cost of each such contract, to be calculated at the time agencies or public benefit corporations enter into a new contract or if a contract is amended. The provisions of this bill became effective August 2, 2005.

**To all State Departments, Agency Heads and Public Benefit Corporations
IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND**

OSC will report to DOL on all construction-related ("D") contracts approved during the month, including contract amendments, and then DOL will bill agencies the appropriate assessment monthly. An agency may then make a determination if any of the billed contracts are exempt and so note on the bill submitted back to DOL. For any instance where an agency is unsure if a contract is or is not exempt, they can call the Bureau of Public Work at the number noted below for a determination. Payment by check or journal voucher is due to DOL within thirty days from the date of the billing. DOL will verify the amounts and forward them to OSC for processing.

For those contracts which are not approved or administered by the Comptroller, monthly reports and payments for deposit into the Public Work Enforcement Fund must be provided to the Administrative Finance Bureau at the DOL within 30 days of the end of each month or on a payment schedule mutually agreed upon with DOL.

Reports should contain the following information:

- Name and billing address of State agency or public benefit corporation;
- State agency or public benefit corporation contact and phone number;
- Name and address of contractor receiving the award;
- Contract number and effective dates;
- Contract amount and PWEF assessment charge (if contract amount has been amended, reflect increase or decrease to original contract and the adjustment in the PWEF charge); and
- Brief description of the work to be performed under each contract.

Checks and Journal Vouchers, payable to the "New York State Department of Labor" should be sent to:

Department of Labor
Administrative Finance Bureau-PWEF Unit
Building 12, Room 464
State Office Campus
Albany, NY 12226

Any questions regarding billing should be directed to NYSDOL's Administrative Finance Bureau-PWEF Unit at (518) 457-3624 and any questions regarding Public Work Contracts should be directed to the Bureau of Public Work at (518) 457-5589.

Required Notice under Article 25-B of the Labor Law

**Attention All Employees, Contractors and Subcontractors:
You are Covered by the Construction Industry Fair Play Act**

The law says that you are an employee unless:

- You are free from direction and control in performing your job, **and**
- You perform work that is not part of the usual work done by the business that hired you, **and**
- You have an independently established business.

Your employer cannot consider you to be an independent contractor unless all three of these facts apply to your work.

It is against the law for an employer to misclassify employees as independent contractors or pay employees off the books.

Employee Rights: If you are an employee, you are entitled to state and federal worker protections. These include:

- Unemployment Insurance benefits, if you are unemployed through no fault of your own, able to work, and otherwise qualified,
- Workers' compensation benefits for on-the-job injuries,
- Payment for wages earned, minimum wage, and overtime (under certain conditions),
- Prevailing wages on public work projects,
- The provisions of the National Labor Relations Act, and
- A safe work environment.

It is a violation of this law for employers to retaliate against anyone who asserts their rights under the law. Retaliation subjects an employer to civil penalties, a private lawsuit or both.

Independent Contractors: If you are an independent contractor, **you must pay all taxes and Unemployment Insurance contributions required by New York State and Federal Law.**

Penalties for paying workers off the books or improperly treating employees as independent contractors:

- **Civil Penalty**
First offense: Up to \$2,500 per employee
Subsequent offense(s): Up to \$5,000 per employee
- **Criminal Penalty**
First offense: Misdemeanor - up to 30 days in jail, up to a \$25,000 fine and debarment from performing public work for up to one year.
Subsequent offense(s): Misdemeanor - up to 60 days in jail or up to a \$50,000 fine and debarment from performing public work for up to 5 years.

If you have questions about your employment status or believe that your employer may have violated your rights and you want to file a complaint, call the Department of Labor at (866) 435-1499 or send an email to dol.misclassified@labor.ny.gov. All complaints of fraud and violations are taken seriously. You can remain anonymous.

Employer Name:

IA 999 (09/16)

WE ARE YOUR DOLDepartment
of LaborNew York State Department of Labor
Bureau of Public Work

Attention Employees

THIS IS A: **PUBLIC WORK PROJECT**

If you are employed on this project as a **worker, laborer, or mechanic** you are entitled to receive the **prevailing wage and supplements rate** for the classification at which you are working.

Your pay stub and wage notice received upon hire must clearly state your wage rate and supplement rate.

Chapter 629 of the Labor Laws of 2007:

These wages are set by law and must be posted at the work site. They can also be found at:
<https://dol.ny.gov/bureau-public-work>



If you feel that you have not received proper wages or benefits, please call our nearest office.*

Albany	(518) 457-2744	Patchogue	(631) 687-4882
Binghamton	(607) 721-8005	Rochester	(585) 258-4505
Buffalo	(716) 847-7159	Syracuse	(315) 428-4056
Garden City	(516) 228-3915	Utica	(315) 793-2314
New York City	(212) 932-2419	White Plains	(914) 997-9507
Newburgh	(845) 568-5287		

* For New York City government agency construction projects, please contact the Office of the NYC Comptroller at (212) 669-4443, or www.comptroller.nyc.gov – click on Bureau of Labor Law.

Contractor Name: _____

Project Location: _____

Requirements for OSHA 10 Compliance

Article 8 §220-h requires that when the advertised specifications, for every contract for public work, is \$250,000.00 or more the contract must contain a provision requiring that every worker employed in the performance of a public work contract shall be certified as having completed an OSHA 10 safety training course. The clear intent of this provision is to require that all employees of public work contractors, required to be paid prevailing rates, receive such training "prior to the performing any work on the project."

The Bureau will enforce the statute as follows:

All contractors and sub contractors must attach a copy of proof of completion of the OSHA 10 course to the first certified payroll submitted to the contracting agency and on each succeeding payroll where any new or additional employee is first listed.

Proof of completion may include but is not limited to:

- Copies of bona fide course completion card (*Note: Completion cards do not have an expiration date.*)
- Training roster, attendance record or other documentation from the certified trainer pending the issuance of the card.
- Other valid proof

****A certification by the employer attesting that all employees have completed such a course is not sufficient proof that the course has been completed.**

Any questions regarding this statute may be directed to the New York State Department of Labor, Bureau of Public Work at 518-457-5589.

Introduction to the Prevailing Rate Schedule

Information About Prevailing Rate Schedule

This information is provided to assist you in the interpretation of particular requirements for each classification of worker contained in the attached Schedule of Prevailing Rates.

Classification

It is the duty of the Commissioner of Labor to make the proper classification of workers taking into account whether the work is heavy and highway, building, sewer and water, tunnel work, or residential, and to make a determination of wages and supplements to be paid or provided. It is the responsibility of the public work contractor to use the proper rate. If there is a question on the proper classification to be used, please call the district office located nearest the project. District office locations and phone numbers are listed below.

Prevailing Wage Schedules are issued separately for "General Construction Projects" and "Residential Construction Projects" on a county-by-county basis.

General Construction Rates apply to projects such as: Buildings, Heavy & Highway, and Tunnel and Water & Sewer rates.

Residential Construction Rates generally apply to construction, reconstruction, repair, alteration, or demolition of one family, two family, row housing, or rental type units intended for residential use.

Some rates listed in the Residential Construction Rate Schedule have a very limited applicability listed along with the rate. Rates for occupations or locations not shown on the residential schedule must be obtained from the General Construction Rate Schedule. Please contact the local Bureau of Public Work office before using Residential Rate Schedules, to ensure that the project meets the required criteria.

Payrolls and Payroll Records

Contractors and subcontractors are required to establish, maintain, and preserve for not less than six (6) years, contemporaneous, true, and accurate payroll records.

Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury.

Paid Holidays

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

Overtime

At a minimum, all work performed on a public work project in excess of eight hours in any one day or more than five days in any workweek is overtime. However, the specific overtime requirements for each trade or occupation on a public work project may differ. Specific overtime requirements for each trade or occupation are contained in the prevailing rate schedules.

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays.

The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Supplemental Benefits

Particular attention should be given to the supplemental benefit requirements. Although in most cases the payment or provision of supplements is straight time for all hours worked, some classifications require the payment or provision of supplements, or a portion of the supplements, to be paid or provided at a premium rate for premium hours worked. Supplements may also be required to be paid or provided on paid holidays, regardless of whether the day is worked. The Overtime Codes and Notes listed on the particular wage classification will indicate these conditions as required.

Effective Dates

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. The rate listed is valid until the next effective rate change or until the new annual determination which takes effect on July 1 of each year. All contractors and subcontractors are required to pay the current prevailing rates of wages and supplements. If you have any questions please contact the Bureau of Public Work or visit the New York State Department of Labor website (www.labor.ny.gov) for current wage rate information.

Apprentice Training Ratios

The following are the allowable ratios of registered Apprentices to Journey-workers.

For example, the ratio 1:1,1:3 indicates the allowable initial ratio is one Apprentice to one Journeyworker. The Journeyworker must be in place on the project before an Apprentice is allowed. Then three additional Journeyworkers are needed before a second Apprentice is allowed. The last ratio repeats indefinitely. Therefore, three more Journeyworkers must be present before a third Apprentice can be hired, and so on.

Please call Apprentice Training Central Office at (518) 457-6820 if you have any questions.

Title (Trade)	Ratio
Boilermaker (Construction)	1:1,1:4
Boilermaker (Shop)	1:1,1:3
Carpenter (Bldg.,H&H, Pile Driver/Dockbuilder)	1:1,1:4
Carpenter (Residential)	1:1,1:3
Electrical (Outside) Lineman	1:1,1:2
Electrician (Inside)	1:1,1:3
Elevator/Escalator Construction & Modernizer	1:1,1:2
Glazier	1:1,1:3
Insulation & Asbestos Worker	1:1,1:3
Iron Worker	1:1,1:4
Laborer	1:1,1:3
Mason	1:1,1:4
Millwright	1:1,1:4
Op Engineer	1:1,1:5
Painter	1:1,1:3
Plumber & Steamfitter	1:1,1:3
Roofer	1:1,1:2
Sheet Metal Worker	1:1,1:3
Sprinkler Fitter	1:1,1:2

If you have any questions concerning the attached schedule or would like additional information, please contact the nearest BUREAU of PUBLIC WORK District Office or write to:

New York State Department of Labor
Bureau of Public Work
State Office Campus, Bldg. 12
Albany, NY 12226

District Office Locations:	Telephone #	FAX #
Bureau of Public Work - Albany	518-457-2744	518-485-0240
Bureau of Public Work - Binghamton	607-721-8005	607-721-8004
Bureau of Public Work - Buffalo	716-847-7159	716-847-7650
Bureau of Public Work - Garden City	516-228-3915	516-794-3518
Bureau of Public Work - Newburgh	845-568-5287	845-568-5332
Bureau of Public Work - New York City	212-932-2419	212-775-3579
Bureau of Public Work - Patchogue	631-687-4882	631-687-4902
Bureau of Public Work - Rochester	585-258-4505	585-258-4708
Bureau of Public Work - Syracuse	315-428-4056	315-428-4671
Bureau of Public Work - Utica	315-793-2314	315-793-2514
Bureau of Public Work - White Plains	914-997-9507	914-997-9523
Bureau of Public Work - Central Office	518-457-5589	518-485-1870

**AGREEMENT,
FAITHFUL
PERFORMANCE
BOND,
AND
LABOR AND
MATERIAL
BOND**

CONTRACT NO:

COUNTY:

**NEW YORK STATE
THRUWAY AUTHORITY**

A G R E E M E N T

NEW YORK STATE THRUWAY AUTHORITY

AGREEMENT

CONTRACT NO:

This **AGREEMENT**, entered into this day of _____, by the **NEW YORK STATE THRUWAY AUTHORITY** (hereinafter referred to as the "**AUTHORITY**") having its principal office at 200 Southern Blvd. (P. O. Box 189, Albany, NY 12201) in the County of Albany and State of New York and hereinafter called the "**CONTRACTOR**",

☐ a corporation organized and existing under the laws of the State of

☐ a partnership, consisting of

☐ an individual conducting business as

the location of whose principal office is

WITNESSETH: That the Authority and the Contractor for the consideration hereinafter named agree as follows:

ARTICLE 1. WORK TO BE DONE.

The Contractor shall (a) furnish all the materials, appliances, tools and labor of every kind required, and construct and complete in the most substantial and skillful manner, the construction, improvement or reconstruction of the project on or before the completion date of the as further described in ARTICLE 4, and as generally identified and shown on the plans entitled:

in accordance with the "Standard Specifications" of the New York State Department of Transportation, which contain the information for bidders; form of proposal, agreement, and bonds; general specifications and conditions or contract; materials of construction; and payment items; and (b) do everything required by the Contract (Contract Documents) as defined herein.

The Contractor agrees that its proposal contained herein is based upon performing all the work of the Contract in accordance with a schedule that will result in the completion of the total works by the Date of Completion of the Contract and all intermediate stage and phase completion requirements of the contract, while adhering to all restrictions set forth in the Schedule and Suspension of Work, the Thruway Traffic Plan, and the General and Special Notes, and that the work will be performed at the unit bid prices, as shown on the contract documents and as detailed in the specifications and notes, utilizing the Labor Force, Qualified Disadvantaged, Women Owned and Minority Owned Subcontractor Entrepreneurs and Methods and Materials of Construction as described in the Contract Documents and any incorporated Addenda thereto, and conduct its operations in accordance with the Vehicle and Traffic Law, the Rules and Regulations of the NYS Thruway Authority, and the Thruway Operating Rules and General and Special Notes that are part of this proposal. The Contractor further agrees its proposal is not based upon the assumption that any specifications, traffic restrictions, scheduling or phasing/staging requirements will be waived, an extension of Contract Completion Date will be granted, a labor dispensation will be granted, substitution of non-approved products, alternatives or claimed functional equivalents for Specified Construction Materials and Methods will be allowed, or any Value Engineering Proposals will be entertained and approved by the New York State Thruway Authority, and any requests for a substitution, equivalent or alternate, which it proposes, will be accompanied by an agreed price analysis establishing an applicable credit or illustrating cost equal to or greater than the bid amount.

ARTICLE 2. DOCUMENTS FORMING THE CONTRACT.

The Contract (and Contract Documents) shall be deemed to include the advertisement for proposals; the contractor's proposal; the Schedule for Participation By Disadvantaged Business Enterprise Participation goals; the agreement; the "Standard Specifications" including all addenda thereto referred to above; the plans; any addenda and/or amendments to specifications if the same are issued prior to date of receipt of proposal and all provisions required by law to be inserted in the contract whether actually inserted or not. Appendix A, standard clauses for all N.Y State contracts, is attached hereto and is hereby made a part of this agreement as if set forth fully herein.

ARTICLE 3. EXAMINATION OF DOCUMENTS AND SITE.

The Contractor agrees that before making its proposal it carefully examined the contract documents, together with the site of the proposed work, as well as its surrounding territory, and is informed regarding all of the conditions affecting the work to be done and labor and materials to be furnished for the completion of this contract, including the existence of poles, wires, pipes, and other facilities and structures of municipal and other public service corporations on, over or under the site, except latent conditions that meet the requirements of §104-04 and §109-05, and that its information was secured by personal investigation and research.

ARTICLE 4. DATE OF COMPLETION.

The Contractor further agrees that it will begin the work herein embraced within ten days of the effective date hereof, unless the consent of the Authority, in writing, is given to begin at a later date, and that it will prosecute the same so that it shall be entirely completed and performed on or before the completion date shown in Article 1.

No extension beyond the date of completion fixed by the terms of this contract shall be effective unless in writing signed by the Authority. Such extension shall be for such time and upon such terms and conditions as shall be fixed by the Authority, which may include the assessment of liquidated damages and a charge for engineering and inspection expenses actually incurred upon the work, including engineering and inspection expenses incurred upon the work by railroad companies on contracts for grade crossing elimination. Notice of application for such extension shall be filed with the Chief Engineer, Department of Engineering of the Authority at least fifteen days prior to the date of completion fixed by the terms of this agreement.

ARTICLE 5. ALTERATIONS AND OMISSIONS.

The said work shall be performed in accordance with the true intent and meaning of the contract documents without any further expense of any nature whatsoever to the Authority other than the consideration named in this agreement.

The Authority reserves the right at any time during the progress of the work, to alter the plans or omit any portion of the work as it may deem reasonably necessary for the public interest; making allowances for additions and deductions with compensation made in accordance with the Standard Specifications, for this work without constituting grounds for any claim by the contractor for allowance for damages or for loss of anticipated profits, or for any variations between the approximate quantities and the quantities of the work as done.

ARTICLE 6. NO COLLUSION OR FRAUD.

The Contractor hereby agrees that the only person or persons interested as principal or principals in the bid or proposal submitted by the Contractor for this contract are named therein, and that no person other than those mentioned therein has any interest in the above-mentioned proposal or in securing of the award, and that this contract has been secured without any connection with any person or persons other than those named, and that the proposal is in all respects fair and was prepared and the contract was secured without collusion or fraud and that neither any officer nor employee of the New York State Thruway Authority or the State Department of Transportation or either of them has or shall have a financial interest in the performance of the contract or in the supplies, work or business to which it relates, or in any portion of the profits thereof. (See also Section 139-a and 139-b of the State Finance Law referred to in the Standard Specifications, which are made a part of this contract.)

ARTICLE 7. CONTRACT PAYMENTS.

As the work progresses in accordance with the contract and in a manner that is satisfactory to the Authority, the Authority hereby agrees to make payments to the Contractor therefore, based upon the proposal attached hereto and made a part hereof, as follows: The Authority shall, once in each month and on such days as it may fix, make an estimate of the quantity of work done and of material which has actually been put in place in accordance with the terms and conditions of the contract, during the preceding month, and compute the value thereof and pay to the Contractor the moneys due in accordance with Public Authorities Law Section 2880, as detailed in 21 NYCRR Part 109 (Prompt Payment). No monthly estimate shall be rendered unless the Contractor has provided acceptable documentation with regard to actions taken to comply with the M/WBE goals of the contract (see also §109-06 Contract Payments) and the value of the work done equals 5% of the contract amount or \$1,000, whichever is the lesser. Semi-monthly estimates may be rendered provided (a) the value of the work performed in two successive weeks is more than \$100,000 or (b) the Chairman of

the Authority deems it to be for the best interest of the Authority to do so.

Contractor understands and agrees that payments will only be rendered electronically unless payment by paper check is expressly authorized by the Authority, in its sole discretion, due to extenuating circumstances. Contractor shall comply with the Authority's procedures to authorize electronic payments. Authorization forms are available at <http://www.thruway.ny.gov/business/purchasing/epayments/index.html>, by e-mail at suppliermgmt@thruway.ny.gov, or by telephone at (518) 436-2859. Contractor acknowledges that it will not receive payment of any estimates submitted under this Agreement if it does not comply with the Authority's electronic payment procedures, except where the Authority has expressly authorized payment by paper check as set forth above.

ARTICLE 8. PAYMENT DUE TO CONTRACTOR'S NON-COMPLIANCE.

It is further agreed that so long as any lawful or proper direction concerning the work or material given by the Chief Engineer, Department of Engineering of the New York State Thruway Authority, or his/her representative, shall remain uncomplied with, the Contractor shall not be entitled to have any estimate made for the purpose of payment, nor shall any estimate be rendered on account of work done or material furnished until such lawful or proper direction aforesaid has been fully and satisfactorily complied with.

ARTICLE 9. FINAL ACCEPTANCE OF WORK.

When in the opinion of the Thruway Division Director, a Contractor has fully performed the work under the contract, the Thruway Division Director shall recommend to the Chief Engineer, Department of Engineering of the New York State Thruway Authority, the acceptance of the work so completed. If the Chief Engineer, Department of Engineering accepts the recommendation of the Thruway Division Director, he/she shall thereupon by letter notify the Contractor of such acceptance. Copies of such acceptance shall be sent to other interested parties. Prior to the final acceptance of the work by the Chief Engineer, Department of Engineering of the New York State Thruway Authority or a designee, the contract work may be inspected, accepted and approved by other agencies and/or municipalities who will have jurisdiction of the work after final acceptance.

Final acceptance shall be final and conclusive except for defects not readily ascertainable by the New York State Thruway Authority, actual or constructive, fraud, gross mistakes amounting to fraud or other errors which the Contractor knew or should have known about as well as the New York State Thruway Authority's rights under any warranty or guarantee. Final acceptance may be revoked by the New York State Thruway Authority at any time prior to the issuance of the final check, upon the New York State Thruway Authority's discovery of such defects, mistakes, fraud or errors in the work.

ARTICLE 10. FINAL PAYMENT.

After the final acceptance of the work, the Engineer shall prepare a final agreement of the work performed and the materials placed and shall compute the value of such work and materials under and according to the terms of the contract.

This agreement shall be certified, as to its correctness, by the Engineer. Upon approval of such final agreement by the Director, Office of Construction Management, it shall be submitted to the Chief Engineer,

Department of Engineering for final approval. The right, however, is hereby reserved to the Chief Engineer, Department of Engineering to reject the whole or any portion of the final agreement, should the said certificate of the Engineer be found or known to be inconsistent with the terms of the agreement or otherwise improperly given. All certificates, upon which partial payments may have been made being merely estimates, shall be subject to correction in the final certificate or final agreement.

ARTICLE 11. RIGHT TO SUSPEND WORK AND CANCEL CONTRACT.

Article 11.1 General Right to Suspend and Cancel Contract.

It is further mutually agreed that if at any time during the prosecution of the work the Authority shall determine that the work is not being performed in accordance with the Contract or for the best interest of the Authority, the Chief Engineer, Department of Engineering, may proceed in any of the following ways:

- 1) Temporarily suspend the execution of the work by the Contractor, and the Chief Engineer of the Authority may then proceed with the work under his/her own direction in such manner as will accord with the Contract Documents and be for the best interests of the Authority; or
- 2) Terminate the Contract while it is in progress, and thereupon proceed with the work by a new contract negotiated or publicly advertised, by the use of his/her own forces, by calling upon the Surety to complete the Work in accordance with the Contract Documents, or by a combination of any such methods; or
- 3) Cancel the Contract and re-advertise and re-procure in accordance with applicable law; or
- 4) Complete the Work under the Authority's direction in such a manner as will accord with the Contract Documents and be for the best interests of the Authority.

Any excess in the cost of completing the Contract beyond the Contract Price for which it was originally awarded shall be charged to and paid by the Contractor failing to perform the Work or its Surety, all pursuant to the provisions of Section 40 of the New York State Highway Law.

In the event of suspension or termination, the Contractor shall be paid its costs, including contract close-out costs, and profit on work satisfactorily performed and project design costs actually incurred up to the time of termination, less an amount necessary to satisfy any claims, liens or judgments against the Contractor. The Contractor shall promptly submit its termination claim. The Contractor will only be paid the contract price for materials delivered and accepted, or services performed in accordance with the manner or performance set forth in this contract, less an amount necessary to satisfy any claims, liens or judgments against the Contractor.

Whenever the Authority determines to suspend or stop Work under this Contract, a written notice sent by mail to the Contractor at its address and to its Sureties at their respective addresses shall be sufficient notice of its action in the premises.

Article 11.2 Termination for Cause.

- A. If at any time during the prosecution of the work the Chief Engineer shall determine that the work under the Contract is not being performed according to the Contract or any

provision of the Contract is violated by the Contractor or by any subcontractor or that an Event of Default (as defined below) has occurred hereunder, the Chief Engineer, in his or her sole and absolute discretion, may proceed in any of the following ways:

- (1) Suspend or stop work by the Contractor, and the Chief Engineer may then complete the Work under his/her own direction in such manner as further described in the Contract Documents and as determined by the Chief Engineer to be in the best interests of the Authority; or
- (2) Terminate the Contract while it is in progress, and thereupon complete the work by: a new contract negotiated or publicly advertised; use of the Authority's own forces; calling upon the Surety to complete the Work in accordance with the Contract; or a combination of any such methods; or
- (3) Terminate the Contract and re-advertise as provided in law or if applicable, demand upon the Surety to complete any and all remaining work pursuant to the terms of the Contract and the Faithful Performance Bond.

As used herein, an "Event of Default" shall mean a material breach of the Contract by the Contractor which, without limitation, the following has occurred: (i) the Contractor has failed to begin the work in accordance with the Contract requirements; (ii) performance of this Contract has been unnecessarily or unreasonably delayed, (iii) the Contractor has willfully violated any of the provisions of the Contract or has not executed the same in good faith and in accordance with this Contract; (iv) the Contractor has abandoned the work; (v) the Contractor has become insolvent (other than as a bankrupt), or has assigned the proceeds of this Contract for the benefit of creditors, or taken advantage of any insolvency statute or debtor or creditor law or if his property or affairs have been put in the hands of a receiver; (vi) the Contractor has failed to obtain an approval required by the Contract; (vii) the Contractor has failed to provide the required insurances; (viii) the Contractor has failed to provide "adequate assurance" as required; or (ix) the Contractor is found to be non-responsible.

- B. Any excess in the cost of completing the Contract beyond the price for which it was originally awarded shall be charged to and paid by the Contractor failing to perform the work or by the Contractor's Surety, pursuant to the terms and conditions of Section 40 of the New York State Highway Law and the Faithful Performance Bond.
- C. Whenever the Authority determines to suspend, stop work, or terminate under this provision of the Contract, the Contractor and Surety shall receive written notice specifying the basis for such default (the "Default Notice"). Contractor shall have fifteen (15) days from the date of the Default Notice to cure such default, except that, at Authority's sole discretion, the Authority may extend such fifteen (15) day period for such additional period as the Authority shall deem appropriate without waiver of any of its rights hereunder. The Default Notice shall specify the date the Contractor is to discontinue all work if such default is not timely cured (the "Termination Date"). If the Event of Default is not cured or arrangements satisfactory to the Authority are not made (as evidenced in writing by the Authority) within the designated cure period, then Contractor shall suspend work and/or the Contract shall terminate, as the case may be, upon the Termination Date.

- D. Upon occurrence of an Event of Default or a termination for cause pursuant to this Article, the Authority has the remedies set forth in the Faithful Performance Bond, the Contract, and all remedies at law or in equity.
- E. In the event the termination for cause is determined to be improper, the termination shall be deemed a Termination for Convenience as identified in Article 11.3.

Article 11.3 Termination for Convenience.

- A. The Authority, at any time, may terminate the Contract in whole or in part. Any such termination shall be effected by delivering to the Contractor a written notice of termination specifying the extent to which performance of work under the Contract is terminated and the date upon which the termination becomes effective. Upon receipt of the notice of termination, the Contractor shall act promptly to minimize the expenses resulting from the termination.
- B. The Authority shall pay the Contractor for work of the contract performed by the Contractor and accepted by the Authority for the period extending from the end of the period covered by the last approved Application for Payment up to the effective date of the termination, an amount determined in accordance with the Contract Documents. In no event shall the Contractor be entitled to compensation in excess of the total consideration of the Contract. In no event shall the Contractor be entitled to overhead or profit on the work not performed.
- C. In the event of such termination, the Authority may take over the work and prosecute the Contract to completion and may take possession of and may utilize such materials, appliances, and equipment on the site and necessary or useful in completing the work. The Authority also has the right to suspend the execution of the Work for convenience and/or to terminate the Contract for convenience.

Whenever the New York State Thruway Authority determines to suspend or stop work under the contract, a written notice sent by mail to the Contractor at its address and to the sureties at their respective addresses, shall be sufficient notice of its action in the premises.

Article 11.4 Termination for Vendor Responsibility.

- A. Contractor shall at all times during the Contract term remain responsible. Contractor agrees, if requested by the Authority, to present evidence of its continuing legal authority to do business in New York State, integrity, experience, ability, prior performance, and organizational and financial capacity.
- B. The Authority, in its sole discretion, reserves the right to suspend any or all activities under this Contract, at any time, when it discovers information that calls in to question the responsibility of Contractor. In the event of such suspension, Contractor will be given written notice outlining the particulars of such suspension. Upon issuance of such notice, Contractor shall comply with the terms of the suspension order. Contract activity may resume at such time as the Authority issues a written notice authorizing a resumption of performance under the Contract.
- C. Notwithstanding any other provision of this Contract, if the Authority determines Contractor to be non-responsible, the Authority shall have the right to terminate the Contract for cause pursuant to the terms of Article 11.2 - Termination for Cause herein.

In such event, the Authority shall have all rights and remedies set forth in Article 11.2, including, without limitation, the right to complete Contractor's contractual requirements in any manner the Authority may deem advisable and to pursue available legal or equitable remedies for the breach.

- D. In no event shall termination of the Contract by the Authority for reasons of Contractor's non-responsibility be deemed a breach by the Authority, nor shall the Authority be liable for any damages or lost profits or otherwise that Contractor may incur as a result of such termination.
- E. The Authority may require at any time the removal of a subcontractor to the Contractor that the Authority determines is not responsible.

ARTICLE 12. DETERMINATION AS TO VARIANCES.

In any case of any ambiguity in the plans, specifications or maps, or between any of them, the matter must be immediately submitted to the Chief Engineer, Department of Engineering, who shall adjust the same, and his/her decision in relation thereto shall be final and conclusive upon the parties.

ARTICLE 13. SUCCESSORS AND ASSIGNS.

This Agreement shall bind the successors, assigns and representatives of the parties hereto.

ARTICLE 14. INTERNATIONAL BOYCOTT PROHIBITION.

In accordance with Chapter 406 of the Laws of 1981, the Contractor hereby promises, asserts and represents that neither the Contractor nor any substantially owned or affiliated person, firm, partnership or corporation has participated, is participating or shall participate in an international boycott in violation of the provisions of the United States Export Administration Act of 1969, as amended, or the United States Export Administration Act of 1979, or the effective Regulations of the United States Department of Commerce promulgated under either act.

It is understood further that the Authority in awarding a contract does so in material reliance upon the promise and representation made by the Contractor in the foregoing paragraph and that such contract shall be rendered forfeit and void by the State Comptroller if subsequent to the bid execution date, the Contractor or such owned or affiliated person, firm, partnership or corporation has been convicted of a violation of the aforesaid Acts or Regulations or has been found upon final determination of the United States Commerce Department or any other appropriate agency of the United States to have violated such Acts or Regulations.

The Contractor agrees to and shall notify the Chief Engineer, Department of Engineering and the Director of the Office of Construction Management and the Director of State Expenditures in the Office of the State Comptroller of any such conviction or final determination of violation within five (5) days thereof.

ARTICLE 15. CERTIFICATION OF STATE FINANCE LAW SECTIONS 139-J AND 139-K.

By execution of this Agreement the Contractor certifies that all information provided with respect to New York State Finance Law Section 139-j and Section 139-k is complete, true and accurate. The Authority shall have a right to terminate this Agreement in the event the Authority finds that the certification made by the Contractor in accordance with New York State Finance Law Sections 139-j and 139-k was intentionally false or intentionally incomplete. This

includes the Authority's right to terminate this Agreement at any time in the event the Authority finds that Contractor is non-responsible or has failed to accurately disclose vendor responsibility information.

ARTICLE 16. WRITTEN NOTICES.

All notices permitted or required hereunder shall be in writing and transmitted by either:

- a. certified or registered United States mail, return receipt requested;
- b. facsimile transmission;
- c. personal delivery;
- d. expedited delivery service; or
- e. e-mail.

Such notices shall be addressed to the individuals or titles named in the contract documents, or which are designated by the Contractor or the Authority at the pre-construction meeting, or which are designated by the Authority or the Contractor from time to time during the course of the Contract pursuant to the requirements herein.

Any such notice shall be deemed to have been given either at the time of personal delivery or, in the case of expedited delivery service or certified or registered United States mail, as of the date of first attempted delivery at the address and in the manner provided herein, or in the case of facsimile transmission or email, upon receipt.

The parties may, from time to time, specify a new or different address in the United States as their address for the purpose of receiving notice under this Agreement by giving fifteen (15) days written notice to the other party sent in accordance herewith. The parties agree to mutually designate individuals as their respective representatives for the purposes of receiving notices under this Agreement. Additional individuals may be designated in writing by the parties for purposes of implementation and administration/billing, resolving issues and problems and/or for dispute resolution.

ARTICLE 17. SUBCONTRACTING.

Contractor agrees not to subcontract any of its services without the prior written approval of the Authority.

Contractor retains ultimate responsibility for all services performed under the Agreement and shall pay any subcontractors promptly for work performed under this Agreement. Contractor shall be fully responsible to the Authority for the acts and omissions of its subcontractors, and of persons either directly or indirectly employed by them, just as Contractor is fully responsible to the Authority for the acts and omissions of persons directly employed by Contractor.

All subcontracts shall be in writing and shall contain provisions, which are functionally identical to, and consistent with, the provisions of this Agreement including, but not limited to, the body of this Agreement, Appendix A – Standard Clauses for New York State Thruway Authority Contracts, and the Contract Documents. Unless expressly waived in writing by the Authority, all subcontracts between the Contractor and its subcontractors shall expressly name the Authority, as the sole intended third party beneficiary of such subcontract. The Authority reserves the right to review and approve or reject any subcontract, as well as any amendment to said subcontract(s), and this right shall not make the Authority a party to any subcontract or create any right, claim, or interest in the subcontractor or proposed

subcontractor against the Authority. The Authority shall have the right to withdraw its consent to a subcontractor if, at the sole discretion of the Authority, it appears that the subcontract will delay, prevent, or otherwise impair Contractor's performance of services under this Agreement. Upon request, Contractor shall furnish to the Authority copies of all Contracts between Contractor and its subcontractors used to perform services for this Agreement.

The Authority reserves the right, at any time during the term of the Agreement, to verify that the written subcontract between Contractor and its subcontractors is in compliance with all of the provisions of this Article 17 and any subcontract provisions contained in this Agreement.

Contractor shall give the Authority immediate notice in writing of the initiation of any legal action or suit which relates in any way to a subcontract with a subcontractor or which may affect the performance of the Contractor's duties under the Agreement. Any subcontract shall not relieve the Contractor in any way of any responsibility, duty and/or obligation of the Agreement.

If at any time during performance under this Agreement total compensation to a subcontractor exceeds or is expected to exceed \$100,000, said subcontractor shall be required to electronically submit and certify a new Vendor Responsibility Questionnaire directly to the Office of the New York State Comptroller, or submit and certify all necessary updated information thereof.

Nothing contained in this Agreement shall create any contractual relationship between a subcontractor and the Authority.

ARTICLE 18. CONFIDENTIALITY AND NON-DISCLOSURE.

- A. "Confidential Information" means any information not generally known to the public, or that the Authority claims is confidential, whether oral, written, or electronic, that the Authority discloses, directly or indirectly, through any means of communication, to Contractor. Confidential Information includes, but is not limited to, operational and infrastructure information relating to: bid documents, plans, drawings, specifications, reports, product information and data; business and security processes and procedures; personnel and organizational data; financial statements; information system IP addresses, passwords, security controls, architectures and designs; and such other data, information and images that the Authority deems confidential.
- B. Confidential Information does not include information which, at the time of the Authority's disclosure to Contractor: (1) is already in the public domain or becomes publicly known through no act of Contractor; or (2) is already known by Contractor free of any confidentiality obligations.

If Contractor wants to disclose Confidential Information, it shall notify the Authority and specify the Confidential Information it wants to disclose. Contractor may only disclose such Confidential Information if the Authority approves such disclosure in writing, subject to such other terms and conditions as the Authority may require. Such approval, if given, shall only apply to the particular request and the specific Confidential Information for

which it is given.

If Contractor is required to disclose or make available, directly or indirectly, Confidential Information pursuant to statute, court or administrative order, subpoena, contractual obligation, or otherwise by law, Contractor shall: (1) notify the Authority that it has received such legal demand as soon as practicable, but in all events prior to any disclosure; (2) permit the Authority to take the steps it deems necessary and appropriate to protect the Confidential Information from disclosure; (3) cooperate to the fullest extent possible under the law with the Authority's efforts to protect the Confidential Information from disclosure; and (4) disclose only such Confidential Information, and only such portions thereof, as is required to satisfy the legal demand, and limit any such disclosure of Confidential Information to the fullest extent permissible under the law.

- C. Contractor may use Confidential Information solely for the purposes of providing services to the Authority pursuant to this Agreement. Contractor may make copies of Confidential Information but only to the extent necessary for the disclosures and uses permitted by this Agreement. Contractor will make commercially reasonable efforts to ensure that any copy of Confidential Information that is made is marked to show that it is or contains Confidential Information. Contractor may share Confidential Information with third parties: (i) that are required for Contractor's provision of services to the Authority pursuant to this Agreement (e.g., Contractors and subcontractors); and (ii) that agree in writing to be bound by the confidentiality provisions of this Agreement; however, Contractor may share only that Confidential Information that is necessary to the third party's contribution to Contractor's provision of services to the Authority pursuant to this Agreement and Contractor must first obtain the Authority's prior written consent.

The Authority's disclosure of Confidential Information to Contractor shall not convey to Contractor any right, title, or interest in or to such Confidential Information, and this Agreement does not transfer ownership of Confidential Information or grant a license thereto. The Authority shall retain all right, title, and interest in and to all such Confidential Information at all times.

- D. Contractor shall hold Confidential Information confidential to the maximum extent permitted by law. Contractor shall safeguard Confidential Information with at least the same level of care and security that Contractor uses to maintain and protect from disclosure its own confidential information, using all reasonable and necessary security measures, devices, and procedures that Contractor uses to maintain its own confidential information, but in all events with not less than reasonable care.

Contractor shall take reasonable steps to prevent unauthorized access to, use of, or disclosure of Confidential Information, including without limitation, by protecting its passwords and other log-in information. Contractor shall notify the Authority immediately of any known or suspected misuse or misappropriation of Confidential Information and shall use its best efforts to stop said misuse or misappropriation.

- E. Upon written request of the Authority, or upon expiration or termination of this Agreement, Contractor shall return all Confidential Information to the Authority, or certify in writing that it has been destroyed and no copies exist.

- F. Contractor agrees that breach of this Article 18 would cause the Authority irreparable

injury, for which monetary damages would not provide adequate compensation, and that in addition to any other remedy, the Authority will be entitled to injunctive relief against such breach or threatened breach, without proving actual damages or posting a bond or other security.

- G. Without limiting the foregoing, the obligations and assurances involving Confidential Information pursuant to this Agreement shall survive termination or expiration of this Agreement.

ARTICLE 19. NEW YORK STATE HUMAN RIGHTS LAW, ARTICLE 15 OF THE EXECUTIVE LAW.

The New York State Human Rights Law, Article 15 of the Executive Law, prohibits discrimination (including to refuse to hire or employ or to bar or to discharge from employment an individual or to discriminate against such individual in compensation or in terms, conditions or privileges of employment) and harassment based on age, race, creed, color, national origin, sex, , sexual orientation, gender identity or expression, disability, marital status, familial status, domestic violence victim status, prior arrest or conviction record, military status or predisposing genetic characteristics, or because the individual has opposed any practices forbidden under the Human Rights Law or because the individual has filed a complaint, testified or assisted in any proceeding under the Human Rights Law, regardless of whether such harassment would be considered severe or pervasive under precedent applied to harassment claims. Harassment is an unlawful discriminatory practice when it subjects an individual to inferior terms, conditions or privileges of employment because of the individual's membership in one or more of these protected categories.

The Human Rights Law may also require reasonable accommodation for persons with disabilities and pregnancy-related conditions. A reasonable accommodation is an adjustment to a job or work environment that enables a person with a disability to perform the essential functions of a job in a reasonable manner. The Human Rights Law may also require reasonable accommodation in employment on the basis of Sabbath observance or religious practices.

Generally, the Human Rights Law applies to:

- all employers of four or more people, employment agencies, labor organizations and apprenticeship training programs in all instances of discrimination or harassment;
- employers with fewer than four employees in all cases involving sexual harassment; and,
- any employer of domestic workers in cases involving sexual harassment or harassment based on gender, race, religion or national origin.

In accordance with New York State Executive Order No. 177, by execution of this Agreement, Contractor hereby certifies, that it does not have institutional policies or practices that fail to address the harassment and discrimination of individuals on the basis of their age, race, creed, color, national origin, sex, sexual orientation, gender identity, disability, marital status, military status, or other protected status under the Human Rights Law.

Executive Order No. 177 and the aforementioned certification do not affect institutional policies or practices that are protected by existing law, including but not limited to the First Amendment of the United States Constitution, Article 1, Section 3 of the New York State Constitution, and Section 296(11) of the New York State Human Rights Law.

ARTICLE 20. DEBARMENT CERTIFICATION.

A. The Contractor certifies to the best of its knowledge and belief, that it and its principals:

1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;
2. Have not within a three-year period preceding this contract been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
3. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (A)(2) of this certification; and
4. Have not within a three-year period preceding this application/proposal/contract had one or more public transactions (Federal, State or local) terminated for cause or default.

ARTICLE 21. CONFLICTS OF INTEREST.

- A. Contractor has provided as Exhibit V (attached hereto and made a part of this Agreement), the Vendor Assurance of No Conflict of Interest or Detrimental Effect form, signed by an authorized executive or legal representative attesting that Contractor's performance of the services does not and will not create a conflict of interest with, nor position Contractor to breach any other contract currently in force with the Authority or the State of New York, that Contractor will not act in any manner that is detrimental to any Authority or State of New York project for which Contractor is rendering services.
- B. Contractor hereby reaffirms the attestations made in its proposal and covenants and represents that there is and shall be no actual or potential conflict of interest that could prevent Contractor's satisfactory or ethical performance of duties required to be performed pursuant to the terms of this Agreement. Contractor hereby agrees it shall have a continuing affirmative duty and obligation to notify the Authority immediately of any actual or potential conflicts of interest.
- C. In conjunction with any subcontract under this Agreement, Contractor shall obtain and deliver to the Authority, prior to entering into a subcontract, a Vendor Assurance of No Conflict of Interest or Detrimental Effect form, signed by an authorized executive or legal representative of the subcontractor. Contractor shall also require in any subcontracting agreement that the subcontractor, in conjunction with any further subcontracting agreement, obtain and deliver to the Authority a signed and completed Vendor Assurance of No Conflict of Interest or Detrimental Effect form for each of its subcontractors prior to entering into a subcontract.
- D. The Authority and Contractor recognize that conflicts may occur in the future because

Contractor may have existing, or establish new, relationships. The Authority will review the nature of any relationships and reserves the right to terminate this Agreement for any reason, or for cause, if, in the judgment of the Authority, a real or potential conflict of interest cannot be cured.

ARTICLE 22. ETHICS.

Contractor and subcontractors may hire former State agency or Authority employees. However, as a general rule and in accordance with New York Public Officers Law, former employees of the Authority may neither appear nor practice before the Authority, nor receive compensation for services rendered on a matter before the Authority, for a period of two years following their separation from Authority service. In addition, former Authority employees are subject to a "lifetime bar" from appearing before the Authority or receiving compensation for services regarding any transaction in which they personally participated or which was under their active consideration during their tenure with the Authority.

During the term of the Agreement, Contractor and its subcontractors shall not engage any person who is, or has been at any time, in the employ of the Authority or New York State to perform services under the Agreement in violation of: the provisions of the Public Officers Law ("POL"); the rules, regulations, opinions, guidelines, or policies promulgated or issued by the New York State Joint Commission on Public Ethics ("JCOPE Regulations"); and any other laws applicable to the service of current or former Authority or New York State employees ("Other Laws," and, together with POL and JCOPE Regulations, collectively, the "Ethics Provisions"). Contractor certifies that all of its employees and employees of any subcontractor who are former employees of the Authority or New York State and who are assigned to perform services under the Agreement shall be assigned in accordance with all Ethics Provisions. Further, during the term of the Agreement, no person who is employed by Contractor or its subcontractors and who is disqualified from providing services under the Agreement pursuant to any Ethics Provisions may share in any net revenues Contractor or its subcontractors derives from the Agreement.

Contractor shall identify and provide the Authority with notice of those employees of Contractor or its subcontractors who are former employees of the Authority or New York State and who will be assigned to perform services under the Agreement, and shall ensure that such employees comply with all applicable laws and prohibitions. The Authority may, request that Contractor provide it with whatever information the Authority deems appropriate about each such person's engagement, work cooperatively with the Authority to solicit advice from the New York State Joint Commission on Public Ethics, and, if deemed appropriate by the Authority, instruct any such person to seek the opinion of the Joint Commission on Public Ethics. The Authority shall have the right to withdraw or withhold approval of any subcontractor if utilizing such subcontractor for any work performed hereunder would be in conflict with any of the Ethics Requirements. The Authority shall have the right to cancel or terminate the Agreement at any time if any work performed under the Agreement is in conflict with any Ethics Provisions.

ARTICLE 23. MINORITY AND WOMEN BUSINESS ENTERPRISE GOALS AND SERVICE DISABLED VETERANS OWNED BUSINESS GOALS.

This Contract is subject to State provisions (including State Executive Law 15-A and 5 NYCRR Parts 140-145) concerning the utilization of Minority-Owned Business Enterprises (MBE) and Women-Owned Business Enterprises (WBE) (collectively M/WBE). All State M/WBE requirements are applicable to this Contract. The approved overall combined MBE and WBE participation goal for the project is established in the Contract Documents.

This Contract is subject to State provisions (including State Executive Law 15-A and 5 NYCRR Parts 140-145) concerning the utilization of Service Disabled Veterans Owned Business (SDVOB). All State SDVOB requirements are applicable to this Contract. The approved overall SDVOB participation goal for the project is established in the Contract Documents.

ARTICLE 24. IRAN DIVESTMENT ACT- SECTION 2879-C OF THE PUBLIC AUTHORITIES LAW.

- A. As used in this Article 24, "person" has the meaning set forth in paragraph (e) of subdivision 1 of Section 165-a of the State Finance Law.
- B. As used in this Article 24 "Contract" means this Agreement.
- C. Contractor hereby provides the following certification: By signing this Contract, each person and each person signing on behalf of any other party certifies, and in the case of a joint bid or partnership each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief, that each person is not on the list created pursuant to paragraph (b) of subdivision 3 of Section 165-a of the State Finance Law.

ARTICLE 25. COVENANT AGAINST CONTINGENT FEES.

Contractor warrants that it has not employed or retained any company or person, other than a bona fide employee working for Contractor, to solicit or secure this Agreement, and has not paid or agreed to pay any company or person, other than a bona fide employee, any fee, commission, percentage, brokerage fee, gift, or any other consideration, contingent upon or resulting from the award or making of this Agreement. In the event Contractor violates this warranty, Authority shall have the right to terminate this Agreement without liability, or, in its discretion, to deduct from payments otherwise owed to the Contractor for services provided pursuant to this Agreement the full amount of such fee, commission, percentage, brokerage fee, gift or other consideration.

ARTICLE 26. COMPLIANCE MONITORING.

In the event that the Contractor, its affiliates or any subcontractor is or becomes subject to a compliance monitoring requirement consequent to an agreement with a governmental entity at any time prior to completion of the contract, the Contractor shall promptly notify the Authority of the same. Compliance monitoring means any requirement imposed by a governmental entity arising from an investigation of activities of the Contractor, its affiliates, or any subcontractor concerning alleged compliance violations, pursuant to which the subject entity is obligated to allow an independent third party to review, analyze, investigate or report on that entity's future compliance with governmental rules and/or contractual requirements arising from governmental rules. Said notice shall be in writing and shall include (i) a copy of the order, settlement or other document setting forth the requirement to implement a monitoring program and (ii) the specific requirements and conditions of the required program. If the order, settlement or other document is subject to confidentiality protection that cannot be unilaterally waived by the Contractor or the entity that is subject to the requirement, the Contractor shall cause the subject entity to confirm that it is subject to a compliance monitoring requirement

and to provide a confidential summary of the terms and conditions of the monitoring requirement to the Contractor, with a copy to the Authority.

The Contractor shall further cause the subject entity to promptly notify the Contractor, with a copy to the Authority, of any violations of the monitoring program by the subject entity and of any other concerns expressed by the monitor regarding compliance with the monitoring program requirements. In such event, the Contractor shall provide to the Authority a detailed written report as to whether and to what extent, if any, the violation or concerns expressed by the monitor are relevant to the Contractor's compliance with its Contract obligations, or to the performance of work by the Contractor. The Authority shall at all times have the right to independently investigate whether any matter raised by the monitor will have any effect upon the Contractor's compliance with its Contract obligations or performance of work by the Contractor and/or subject entity. If any such violation occurs or concerns expressed by the monitor involve compliance requirements that are deemed by the Authority to be relevant to the Contract, the Authority shall have the right to require the Contractor to institute, at Contractor expense, additional data keeping, reporting, and/or other safeguard measures, including permitting independent auditing and access to pertinent records of the Contractor or the subject entity to mitigate risk that a similar violation will occur on the project or be a cause for concern with respect to the Contractor's performance of its obligations under the Contract. The Authority's audit rights under the Contract shall include the right to audit and access pertinent records of the Contractor or the subject entity relating to compliance issues described herein.

The Authority agrees to take all reasonable measures to maintain the confidentiality (to the extent permitted by law) of any information provided by Contractor and/or the subject entity pursuant to this Article 26 which the Contractor has reasonably designated as confidential, and the provisions of Appendix A, Section 9 of the New York State Thruway Authority Addendum to the Standard Specifications, of the Agreement shall apply with respect to disclosure of any such Records under the Statute (as defined in such section). Any intra-agency written materials prepared by the Authority, or any written inter-agency materials that are in the possession or control of the Authority, to the extent based on information or records designated as confidential or exempt from disclosure under the Statute as provided in the preceding sentence, shall also be designated and treated as such by the Authority to the fullest extent permitted by law. The Authority may disclose any of the aforementioned information, records and materials to the New York State Department of Transportation, provided that the Department agrees to treat such information, records and material in the same manner as required of the Authority under this paragraph.

The rights and remedies granted to the Authority under this Article 26 are in addition to, and not to the exclusion of, any and all of its rights and remedies under the Contract or at law or in equity.

ARTICLE 27. INDEMNIFICATION.

The Contractor shall be responsible for all damage to life and property due to negligent or otherwise tortious acts, errors or omissions of the Contractor in connection with its services under the Contract Documents. To the fullest extent permitted by law: (a) the Contractor shall indemnify, hold harmless, and release the Authority, the State of New York, any municipality in which the Work is being performed; and/or any public benefit corporation, railroad or public utility whose property or facilities are affected by the Work from suits, claims, actions, damages, and costs of every name and description resulting from the Work under this Contract and until the Final Acceptance thereof; (b) with respect to personal injury or property damage occurring after Final Acceptance and not covered by the indemnity in clause Article 27 (a), the Contractor shall indemnify, hold harmless, and release the Authority, the State of New York, any municipality in which the Work is being performed;

and/or any public benefit corporation, railroad or public utility from suits, claims, actions, damages, and costs of every name and description resulting from negligent or otherwise tortious acts, errors or omissions of the Contractor in connection with its services under the Contract Documents; and (c) the Contractor shall indemnify, hold harmless, and release the Authority's Inspector from suits, claims, actions, damages, and costs involving personal injury and property damage resulting from the Contractor's Work under the Contract during its prosecution and until the Final Acceptance thereof. The Authority may retain such monies from the amount due the Contractor as may be necessary to satisfy any claim for damages recovered against the Authority, the State of New York, any municipality in which the Work is being performed, any public benefit corporation, railroad, or public utility whose property or facilities are affected by the Work, or the Authority's Inspectors. The Contractor's obligation under this paragraph shall not be deemed waived by the failure of the Authority to retain the whole or any part of such monies due the Contractor, or where such suit, action, damages, and/or costs have not been resolved or determined prior to release of any monies to the Contractor under the Contract. Such obligation shall not be deemed limited or discharged by the enumeration or procurement of any insurance for liability for damages imposed by law upon the Contractor, Subcontractors, the Authority, the State, any municipality in which the Work is being performed, any public benefit corporation, railroad, or public utility whose property or facilities are affected by the Work, or any Department consultants or contractors working relative to the Project.

The Contractor has the obligation, at its own expense, for the defense of any action or proceeding which may be brought against the parties specified in this Article. This obligation shall include the cost of attorney fees, disbursements, costs, and other expenses incurred in connection with such action or proceeding. The provisions of this Article shall survive the expiration or termination of the Contract.

Without limiting the generality of the foregoing, Contractor's obligation to indemnify, save harmless and release the Persons identified in this article specifically includes any suits, claims, actions, damages, and costs of every name and description resulting from any spill or release or threatened spill or release of a Hazardous Material (i) attributable to the negligence, willful misconduct or breach of contract by Contractor, its Subcontractors or agents, or (ii) which was brought onto the Site by Contractor or any of its Subcontractors or agents.

Notwithstanding the foregoing, the Authority reserves the right to join such action, at its sole expense, when it determines there is an issue involving a significant public interest. Such obligation does not extend to those suits, actions, damages, and costs of every name which arise out of the sole negligence of the Authority, the State of New York, any municipality in which the Work is being performed, any public benefit corporation, railroad, or public utility whose property or facilities are affected by the Work of the Project, or any Authority consultants or Contractors working relative to the Project, their agents, or their employees.

ARTICLE 28. NOTICES REGARDING CLAIMS, LITIGATION AND RULINGS.

The Contractor shall promptly provide written notice to the Authority of all claims, litigation and governmental rulings pertaining to the work where such claims, litigation or rulings could subject the Authority to liability or substantially impair the completion of the Contract work. With such notice, the Contractor shall include a brief summary of the issue involved and the Contractor's position on such issue. Such written notice is additional to and not in place of any other notices required by the Contract Documents. The Contractor shall cooperate and provide, and shall require all subcontractors to cooperate and provide, such information or

records as may be reasonably requested by the Authority concerning such claims, litigation or rulings.

ARTICLE 29. COOPERATION AND FURTHER ASSURANCES.

Contractor shall cooperate and provide, and shall cause all subcontractors to cooperate and provide, such information as is necessary or requested by the Authority to assist or facilitate the submission by the Authority of any documentation, reports or analysis required by the State, and/or any other governmental entity with jurisdiction over the work. The Contractor shall promptly execute and deliver to the Authority all such instruments and other documents and assurances as are reasonably requested by the Authority to further evidence the obligations of the Contractor under the Contract.

ARTICLE 30. SEVERABILITY.

If any clause, provision, section, article or part of any of the Contract Documents is ruled invalid by a court having proper jurisdiction, the invalidity or unenforceability of any such clause, provision, section, article or part shall not affect the validity or enforceability of the balance of the Contract Documents, which shall be construed and enforced as if the Contract Documents did not contain such invalid or unenforceable clause, provision, section, article or part.

ARTICLE 31. ENVIRONMENTAL REVIEW

Article 31.1 Lead Agency

The Authority reserves the right to be “lead agency” for any compliance with the New York State Environmental Quality Review Act (SEQRA), and the appropriate federal agency shall serve as “lead agency” for the National Environmental Policy Act (NEPA), as may be required for this Agreement or any activity undertaken by Contractor pursuant to this Agreement.

Article 31.2 Executive Order 22

Embodied Carbon Disclosure: For building materials covered by the GreenNY Council Embodied Carbon Guidance, Contractors and designers shall disclose, at regular intervals during the course of the contract period (and no less than once a year), the exact materials/product type and estimated quantities used. For materials for which Environmental Product Declarations (EPDs) exist that comply with the GreenNY Council requirements, Contractors are also required to submit kgCO₂ equivalent estimates by material/product, and quantity used, on the project to date, with a .pdf copy of the EPD or a link to the digital EPD. (Please see the EO22 Special Note contained in the Special Notes section of this proposal).

Contract Number:

In addition to the acceptance of this contract, I also certify that original copies of this signature page will be attached to all other exact copies of this contract.

IN-WITNESS WHEREOF, the parties hereto have executed this agreement on the day and year first above written.

By: _____
Chief Engineer

: _____
Date

Contractor

Approved as to form

Approved:

Thomas P. DiNapoli
State Comptroller

New York State Attorney General

By: _____

Date: _____

(ACKNOWLEDGMENT BY INDIVIDUAL CONTRACTOR)

STATE OF NEW YORK

COUNTY OF _____ ss.:

On this _____ day of _____, 202_,
 before me personally came _____ to me
 known and known to me to be the person described in and who executed the foregoing instrument,
 and acknowledged that he executed the same.

Notary Public

(ACKNOWLEDGMENT BY CO-PARTNERSHIP CONTRACTOR)

STATE OF NEW YORK

COUNTY OF _____ ss.:

On this _____ day of _____, 202_
 before me personally came and appeared _____ to me known and known
 to me to be the person who executed the above instrument, who, being sworn by me, did for himself
 depose and say that he is a member of the firm of _____ consisting of
 himself and _____ and that he executed the foregoing instrument in the
 firm name of _____ and that he had authority to sign same, and he did duly
 acknowledge to me that he executed the same as the act and deed of said firm of
 _____, for the uses and purposes mentioned therein.

Notary Public

(ACKNOWLEDGEMENT OF A CORPORATION)

STATE OF NEW YORK }
 }
 COUNTY OF }

On this _____ day of _____, 202_,
 before me personally came _____, to me known and known to me to
 be the person who executed the above instrument, who being duly sworn by me, did depose and
 say that he/she resides in _____, that he/she is the
 _____ of _____, the corporation
 described in and which executed the above instrument, and that he/she signed his/her name thereto
 on behalf of said Corporation by order of the Board of Directors of said Corporation.

Notary Public

Exhibit V**Vendor Assurance of No Conflict of Interest or Detrimental Effect**

The undersigned entity ("Contractor"), offering to provide services pursuant to this Agreement, as a contractor, joint venture contractor, subcontractor, or consultant, attests that its performance of the services outlined in this Agreement does not and will not create a conflict of interest with nor position the Contractor to breach any other contract currently in force with the New York State Thruway Authority ("Authority").

Furthermore, the Contractor attests that it will not act in any manner that is detrimental to any Authority project on which the Contractor is rendering services. Specifically, the Contractor attests and certifies that:

1. The fulfillment of obligations by the Contractor does not violate any existing contracts or agreements between the Contractor and the Authority;
2. The fulfillment of obligations by the Contractor does not and will not create any conflict of interest, or perception thereof, with any current role or responsibility that the Contractor has with regard to any existing contracts or agreements between the Contractor and the Authority;
3. The fulfillment of obligations by the Contractor does not and will not compromise the Contractor's ability to carry out its obligations under any existing contracts between the Contractor and the Authority;
4. The fulfillment of any other contractual obligations that the Contractor has with the Authority will not affect or influence its ability to perform under the Agreement;
5. During the negotiation and execution of any contract, the Contractor will not knowingly take any action or make any decision which creates a potential for conflict of interest or might cause a detrimental impact to the Authority as a whole including, but not limited to, any action or decision to divert resources from one Authority project to another;
6. In fulfilling obligations under each of its Authority contracts, including this Agreement, the Contractor will act in accordance with the terms of each of its Authority contracts and will not knowingly take any action or make any decision which might cause a detrimental impact to the Authority as a whole including, but not limited to, any action or decision to divert resources from one Authority project to another;
7. No former officer or employee of the Authority or State of New York ("State") who is now employed by the Contractor, nor any former officer or employee of the Contractor who is now employed by the Authority or State, has played a role with regard to the administration of this contract procurement in a manner that may violate section 73(8)(a) of the New York State Public Officers Law; and
8. The Contractor has not and shall not offer to any employee, member or director of the Authority any gift, whether in the form of money, service, loan, travel, entertainment, hospitality, thing or promise, or in any other form, under circumstances in which it could reasonably be inferred that the gift was intended to influence said employee, member or director, or could reasonably be expected to influence said employee, member or director, in the performance of the official duty of said

employee, member or director or was intended as a reward for any official action on the part of said employee, member or director.

Contractor agrees that the Authority recognizes that conflicts may occur in the future because a Contractor may have existing or new relationships. The Authority will review the nature of any such new relationship and reserves the right to terminate the contract for cause if, in its judgment, a real or potential conflict of interest cannot be cured.

This form must be signed by an authorized executive or legal representative.

Contractor Name

Name of Signatory

Title of Signatory

Signature:

Date:

CONTRACT:

COUNTY:

FAITHFUL PERFORMANCE BOND

BOND

Know all men by these presents, that we (hereinafter called the "Principal")

and _____

of _____ (hereinafter called the "Surety") are held and firmly bound unto the New York State Thruway Authority, (hereinafter called the "Authority"), in the full and just sum of _____ good and lawful money of the United States of America for the payment of which said sum of money, well and truly to be made and done, the said Principal binds himself, his heirs, executors, administrators or assignees and the said SURETY binds itself, its successors or assigns, jointly and severally, firmly by these presents.

Signed, sealed and dated this _____ of _____, 202_____,

Whereas, said Principal has entered into a certain written contract bearing date of the _____ day of _____, 202 with the Authority for:

Now, therefore, THE CONDITION OF THIS OBLIGATION IS SUCH that if the said Principal shall well, truly and faithfully perform the work in accordance with the terms of the contract, and with the plans and specifications, and will commence and complete the work within the time prescribed in the contract, on his part to be kept and performed according to the terms and tenor of said contract, and shall protect the said N.Y.S. Thruway Authority against, and pay any excess of cost as provided in said contract, and all amounts, damages, costs and judgments which may be recovered against said N.Y.S. Thruway Authority, N.Y.S. Dept. of Transportation the Commissioner of Transportation and the State of N.Y. or its or any of their officers or agents or which the said aforementioned may be called upon to pay to any person or corporation by reason of any damages, direct or indirect, arising or growing out of the doing of said work, or from the negligence, non-feasance, misfeasance, or malfeasance of any officer, agent or employee of the aforementioned, or suffered or claimed on account of aforesaid work during the time thereof and until the final completion and acceptance of the work, or the manner of doing the same, or the neglect of the said Principal, or his agents, or servants, or the improper performance of the said work by the said Principal, or his agents, or servants, or from any other cause, then this obligation shall be null and void, otherwise to remain in full force and virtue.

In the event of a failure of performance of the contract by the Principal, which shall include, but not be limited to, any breach or default of the contract by the Principal, or in case said contract is forfeited by the Principal in the manner provided for in the contract and the said Surety, for value received, hereby stipulates and agrees, if requested to do so by the Authority, has the option to either remedy the default, or breach or forfeiture of the Principal or take charge and fully perform and complete the work, mentioned and described in said contract and specifications, pursuant to the terms, conditions and covenants thereof and as may be amended, at its own expense. The procedure by which the surety undertakes to discharge its obligations under the bond shall be subject to the advance written approval of the Authority. If the Surety completes the contract, it shall be paid for the actual items of work performed in accordance with the Principal's contract terms and prices. In the event the Surety assumes the rights and obligations of the Principal.

It shall be the duty of the Surety to give unequivocal notice in writing to the Authority, within forty-five (45) days after receipt of written notice from the Authority to the Surety, of the Surety's election to remedy default(s) or breach(es) or forfeiture(s) promptly or to perform and fully complete the contract promptly as provided herein, time being of the essence of this bond. In said notice of election, the Surety shall state the date on which the remedy or performance shall commence. During the period between the Authority's notice and Surety's performance of the contract or remedy of the default, breach or forfeiture, the Surety shall be liable for and agrees to pay any and all reasonable and necessary costs as determined by the Authority to maintain the project site safe and convenient to the public.

It shall also be the duty of the Surety to give prompt notice in writing to the Authority upon completion of the remedy and/or correction of each breach or default or completion of the contract. The surety shall not assert solvency of its Principal or its Principal's denial of default as justification for its failure to give notice of election or for its failure to promptly remedy the breach or default or to complete the contract.

In the event the Surety shall fail to exercise either option or to act promptly then the Authority shall give ten (10) days notice of such failure, both to the Principal and the Surety, and after the expiration of the 10 days the Authority may cause the work to be completed in accordance with the contract, and the Surety and the Principal shall be jointly and severally liable for the amount of the excess cost of completing the contract work beyond the amounts remaining for this contract adjusted for the work actually performed. When the cost of completion of performance by the Obligee is estimated, the Principal and Surety shall pay, free from all liens and encumbrances, the Authority determined estimated completion costs above funds remaining for this contract, to the Authority within 30 days of receipt of the estimate. Adjustment to the Authority's estimated completion cost will be made upon the Authority's final acceptance of the work and appropriate refunds, if any, will be promptly made to the Surety. Any actual costs in excess of the estimated price shall be paid to the Authority promptly on demand. Additionally, Principal and Surety shall be liable for any applicable liquidated and/or engineering costs or damages.

In addition, the said Principal and Surety further agree, as part of this obligation, to pay all damages of any kind to person or property that may result from a failure in any respect to perform and complete said contract including, but not limited to costs necessary to protect the traveling public or to avoid inconvenience to the traveling public, (liquidated damages as provided above) all repair and replacement costs necessary to rectify construction errors, architectural and engineering costs and fees, all Contractor fees, all testing and laboratory fees, and all interest, legal fees and litigation costs incurred by the Authority.

And the said Surety hereby stipulates and agrees that no change, extension, alteration, deduction of addition in or to the terms of the said contract or the plans or specification accompanying the same shall in any wise affect the obligation of said Surety on its bond.

L.S.

(Corporate seal of _____ L.S. Principal

principal if a corporation.) _____ L.S.

(Corporate seal of _____ L.S.
surety.)

_____ L.S. Surety

STATE OF NEW YORK
OFFICE OF THE ATTORNEY GENERAL

I hereby approve the foregoing contract and bond as to form and manner of execution.

Dated _____

Attorney General

(ACKNOWLEDGMENT BY PRINCIPAL, UNLESS IT BE A CORPORATION)

STATE OF NEW YORK,

COUNTY OF _____ ss.:

On this _____ day of _____, 202__, before me personally came _____ to me known, to be the person described in and who executed the foregoing instrument and he acknowledged that he executed the same.

Notary Public

(Notary's seal to be attached.)

(ACKNOWLEDGMENT BY PRINCIPAL, IF A CORPORATION)

STATE OF NEW YORK,

COUNTY OF _____ ss.:

On this _____ day of _____, 202__, before me personally came _____ to me known, who being by me duly sworn, did depose and say that he resides in _____, that he is the _____ of _____, the corporation described in and which executed the foregoing instrument: that he knew the seal of the said corporation: that the seal affixed to said instrument was such corporate seal: that it was so affixed by order of the Board of Directors of said corporation, and that he signed his name thereto by like order.

Notary Public

(ACKNOWLEDGED BY SURETY COMPANY)

STATE OF NEW YORK,

COUNTY OF _____ ss.:

On this _____ day of _____, 202_, before me personally came _____ to me known, who being by me duly sworn, did depose and say that he resides in _____, that he is the _____ of _____, the corporation described in and which executed the foregoing instrument: that he knew the seal of the said corporation: that the seal affixed to said instrument was such corporate seal: that it was so affixed by order of the Board of Directors of said corporation, and that he signed his name thereto by like order.

Notary Public

(Notary's seal to be attached.)

(The Surety Company must append statement of its financial condition and a copy of the resolution authorizing the execution of Bonds by officers of the Company.)

NEW YORK STATE THRUWAY AUTHORITY

LABOR AND MATERIAL BOND

Know all men by these presents,

That, _____
(Name of Principal)

of _____

(hereinafter called the Principal, and _____
(Name of Surety Company)

a corporation of the State of _____, authorized to do business in the State of New York, as
Surety and whose principal office is located in the City of _____, State of _____
(hereinafter called the Surety), are held and firmly bound unto the NEW YORK STATE THRUWAY AUTHORITY,
(hereinafter called the Authority), in the full and just sum of

_____ good and lawful money of the United
States of America, for the payment of which said sum of money, well and truly to be made and done, the said
Principal and Surety bind themselves, their and each of their heirs, administrators, executors, successors and
assigns, jointly and severally, firmly by these presents.

Whereas, said Principal has entered into a certain written contract, with the Authority bearing date _____
_____ day of _____ 202_, with the New York State Thruway Authority for:

Which contract is hereby referred to and made a part here of as fully and to the same extent as if copied at length
herein.

Now therefore, the condition of this obligation is such that if the said Principal shall promptly pay all moneys due
to all persons furnishing labor and materials to him or his subcontractors in the prosecution of work provided for
in said contract. Then this obligation shall be void, otherwise to remain in full force and effect;

Provided, however, that the Comptroller of the State of New York having required the said Principal to furnish
this bond in order to comply with the provisions of Section 137 of the State Finance Law, all rights and remedies
on this bond shall inure solely to such persons and shall be determined in accordance with the provisions,
conditions and limitations of said Section to the same extent as if they were copied at length herein; and

Further, provided, that the place of trial of any action on this bond shall be in the county in which the said contract
was to be performed, or if said contract was to be performed in more than one county, then in any such county,
and not elsewhere.

SIGNED, SEALED AND DELIVERED THIS _____ day of _____, 202_

(Principal(s) Sign Here)
(Affix Corporate Seal If a Corporation)

(Surety Signs Here)
(Affix Corporate Seal of Surety Co.)

FOR PRINCIPAL'S USE ONLY (Use Only One)

(INDIVIDUAL ACKNOWLEDGMENT)
UNLESS A CORPORATION

STATE OF _____

COUNTY OF _____ ss.:

On this _____ day of _____, 202_, before me personally came _____ to me known and known to me to be the person mentioned and described in and who executed in foregoing instrument and he duly acknowledged to me that he executed the same.

Notary Public

(ACKNOWLEDGEMENT OF A CORPORATION)

STATE OF NEW YORK }
 }
COUNTY OF }

On this _____ day of _____, 202_, before me personally came _____, to me known and known to me to be the person who executed the above instrument, who being duly sworn by me, did depose and say that he/she resides in _____, that he/she is the _____ of _____, the corporation described in and which executed the above instrument, and that he/she signed his/her name thereto on behalf of said Corporation by order of the Board of Directors of said Corporation.

Notary Public

FOR SURETY'S USE ONLY

(SURETY ACKNOWLEDGMENT)

STATE OF _____

COUNTY OF _____ ss.:

On this _____ day of _____, 202_, before me personally came _____ that he is the _____ of the _____ the corporation described in and which executed the above instruments; that he knows the seal of said corporation, that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of Said corporation, and that he signed his name thereto by like order.

Notary Public

APPENDIX A**Standard Clauses For New York State Thruway Authority Contracts**

The parties to the attached contract, license, lease, amendment or other agreement of any kind (“the contract” or “this contract”) agree to be bound by the following clauses which are hereby made a part of the contract (the word “Contractor” herein refers to any party and its agents, successors and assigns, other than the Thruway Authority (“Authority”), whether a contractor, licensor, licensee, lessor, lessee or any other party):

1. NON-ASSIGNMENT CLAUSE. This contract may not be assigned by the Contractor nor may its right, title or interest therein be assigned, transferred, conveyed, subcontracted, sublet or otherwise disposed of without the previous consent, in writing, of the Authority and any attempts to assign the contract without the Authority’s written consent are null and void.

2. COMPTROLLER APPROVAL. Where required by law, this contract may require approval of the State Comptroller and shall not be valid until it has been approved by the State Comptroller and filed in its office.

3. WORKERS’ COMPENSATION AND DISABILITY BENEFITS. This contract shall be void and of no force and effect unless the Contractor shall provide and maintain coverage during the life of this contract for the benefit of such employees as are required to be covered by the provisions of the State Workers’ Compensation Law. If employees will be working on, near or over navigable waters, a U.S. Longshore and Harbor Workers’ Compensation Act endorsement must be included.

4. NON-DISCRIMINATION REQUIREMENTS. To the extent required by Article 15 of the State Executive Law (also known as the Human Rights Law) and all other State and Federal statutory and constitutional non-discrimination provisions, the Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, sex (including gender identity or expression), national origin, sexual orientation, military status, age, disability, predisposing genetic characteristics, marital status or domestic violence victim status or because the individual has opposed any practices forbidden under the Human Rights Law or has filed a complaint, testified, or assisted in any proceeding under the Human Rights Law. Furthermore, in accordance with State Labor Law §220-e, if this is a contract for the construction, alteration or repair of any public building or public work or for the manufacture, sale or distribution of materials, equipment or supplies, and to the extent that this contract shall be performed within the State of New York, Contractor agrees that neither it nor its subcontractors shall by reason of race, creed, color, disability, sex or national origin: (a) discriminate in hiring against any New York State citizen who is qualified and

available to perform the work; or (b) discriminate against or intimidate any employee hired for the performance of work under this contract. If this is a building service contract as defined in State Labor Law §230, then, in accordance with §239 thereof, the Contractor agrees that neither it nor its subcontractors shall, by reason of race, creed, color, national origin, age, sex or disability: (a) discriminate in hiring against any New York State citizen who is qualified and available to perform the work; or (b) discriminate against or intimidate any employee hired for the performance of work under this contract. The Contractor is subject to fines of \$50 per person per day for any violation of State Labor Law §§220-e or 239 as well as possible termination of this contract and forfeiture of all moneys due hereunder for a second or subsequent violation.

5. WAGE AND HOURS PROVISIONS. If this is a public work contract covered by Article 8 of the State Labor Law or a building service contract covered by Article 9 thereof, neither the Contractor’s employees nor the employees of its subcontractors may be required or permitted to work more than the number of hours or days stated in said statutes, except as otherwise provided in the State Labor Law and as set forth in prevailing wage and supplement schedules issued by the State Labor Department. Furthermore, the Contractor and its subcontractors must pay at least the prevailing wage rate and pay or provide the prevailing supplements, including the premium rates for overtime pay, as determined by the State Labor Department in accordance with the State Labor Law. Additionally, effective April 28, 2008, if this is a public work contract covered by Article 8 of the New York State Labor Law, the Contractor understands and agrees that the filing of payrolls in a manner consistent with subdivision 3-a of §220 of the New York State Labor Law shall be a condition precedent to payment by the Authority of any Authority approved sums due and owing for work done on the project.

6. NON-COLLUSIVE BIDDING CERTIFICATION. In accordance with State Public Authorities Law §2878, if this contract was awarded based upon the submission of bids, the Contractor warrants, under penalty of perjury, that its bid was arrived at independently and without collusion aimed at restricting competition. The Contractor further warrants that, at the time the Contractor submitted its bid, an authorized and responsible person executed and delivered to the Authority a non-collusive bidding certification on the Contractor’s behalf.

7. INTERNATIONAL BOYCOTT PROHIBITION. In accordance with State Labor Law §220-f, if this contract exceeds \$5,000, the Contractor agrees, as a material condition of this contract, that neither the Contractor nor any substantially owned or affiliated person, firm, partnership, or corporation has participated, is participating, or shall

participate in an international boycott in violation of the Federal Export Administration Act of 1979 (50 USC App. §§2401 et seq.) or regulations thereunder. If such Contractor, or any of the aforesaid affiliates of the Contractor, is convicted or is otherwise found to have violated said laws or regulations upon the final determination of the United States Commerce Department or any other appropriate agency of the United States subsequent to the contract's execution, such contract, amendment or modification thereto shall be rendered forfeit and void. The Contractor shall so notify the Authority within five (5) business days of such conviction, determination or disposition of appeal.

8. **SET-OFF RIGHTS.** The Authority shall have rights of set-off. These rights shall include, but not be limited to, the Authority's option to withhold for the purposes of set-off any moneys due to the Contractor under this contract up to any amounts due and owing by the Contractor to the Authority with regard to this contract, or any other contract with the Authority, including any contract for a term commencing prior to the term of this contract, plus any amounts due and owing to the Authority for any other reason including, without limitation, monetary penalties, adjustments, fees, or claims for damages by the Authority and third parties in connection therewith.

9. **RECORDS.** The Contractor shall establish and maintain complete and accurate books, records, documents, accounts and other evidence directly pertinent to performance under this contract (collectively, "Records") for a period of six (6) years (or any other longer period required by law) following final payment or the termination of this contract, whichever is later, and any extensions thereto. The Authority, State Comptroller, State Attorney General and any other person or entity authorized to conduct an examination shall have access to the Records during normal business hours at an office of the Contractor within New York State, or, if no such office is available, at a mutually agreeable and reasonable venue within the State, during the contract term, any extensions thereof and said six (6) year period thereafter, for purposes of inspection, auditing and copying. As used in this clause, "termination of this contract" shall mean the later of completion of the work of the contract or the end date of the term stated in the contract. The Authority will take reasonable steps to protect from public disclosure those Records which are exempt from disclosure under State Public Officers Law §87 ("Statute") provided that: (i) the Contractor shall timely inform an appropriate Authority official, in writing, that said records should not be disclosed; (ii) said records shall be sufficiently identified; and (iii) designation of said records as exempt under the Statute is reasonable. Nothing contained herein shall diminish, or in any way adversely affect, the Authority's right to discovery in any pending or future litigation.

10. **IDENTIFYING INFORMATION AND PRIVACY NOTIFICATION.** All invoices or New York State standard vouchers submitted for payment for the sale of goods or services or the lease of real or personal property to the

Authority must include the payee's identification number, i.e., the seller's or lessor's identification number. The number is either the payee's Federal employer identification number or Federal social security number, or both such numbers when the payee has both such numbers. Failure to include this number or numbers may delay payment. Where the payee does not have such number or numbers, the payee, on its invoice or New York State standard voucher, must give the reason or reasons why the payee does not have such number or numbers.

The authority to request the above personal information from a seller of goods or services or a lessor of real or personal property, and the authority to maintain such information, is found in State Tax Law §5. Disclosure of this information by the seller or lessor to the Authority is mandatory. The principal purpose for which the information is collected is to enable the State to identify individuals, businesses and others who have been delinquent in filing tax returns or may have understated their tax liabilities and to generally identify persons affected by the taxes administered by the State Commissioner of Taxation and Finance. The information will be used for tax administration purposes and for any other purpose authorized by law.

The above personal information is maintained at the New York State Thruway Authority, Department of Finance and Accounts, P.O. Box 189, Albany, New York 12201.

11. **EQUAL EMPLOYMENT OPPORTUNITIES FOR MINORITIES AND WOMEN.** In accordance with State Executive Law §312, if this contract is: (i) a written agreement or purchase order instrument, providing for a total expenditure in excess of \$25,000, whereby the Authority is committed to expend or does expend funds in return for labor, services, supplies, equipment, materials or any combination of the foregoing, to be performed for, or rendered or furnished to the Authority; or (ii) a written agreement in excess of \$100,000 whereby the Authority is committed to expend or does expend funds for the acquisition, construction, demolition, replacement, major repair or renovation of real property and improvements thereon; or (iii) a written agreement in excess of \$100,000 whereby the owner of a State assisted housing project is committed to expend or does expend funds for the acquisition, construction, demolition, replacement, or major repair or renovation of real property and improvements thereon for such project, then the following shall apply and by signing this contract the Contractor certifies and affirms that it is Contractor's equal employment opportunity policy that:

(a) The Contractor will not discriminate against employees or applicants for employment because of race, creed, color, national origin, sex, age, disability, or marital status, and shall make and document its conscientious and active efforts to employ and utilize minority group members and women in its work force on Authority contracts and will undertake or continue existing programs of affirmative action to ensure that minority group members and women are afforded equal

employment opportunities without discrimination. As used in this clause, "affirmative action" shall mean recruitment, employment, job assignment, promotion, upgrading, demotion, transfer, lay-off or termination, and rates of pay or other forms of compensation.

(b) At the request of the Authority, the Contractor shall request each employment agency, labor union, or authorized representative of workers with which it has a collective bargaining or other agreement or understanding, to furnish a written statement that such employment agency, labor union or representative will not discriminate on the basis of race, creed, color, national origin, sex, age, disability or marital status, and that such union or representative will affirmatively cooperate in the implementation of the Contractor's obligations herein.

(c) The Contractor shall state, in all solicitations or advertisements for employees, that in the performance of this contract all qualified applicants will be afforded equal employment opportunities without discrimination because of race, creed, color, national origin, sex, age, disability or marital status.

The Contractor shall include the provisions of (a), (b) and (c) above in every subcontract over \$25,000 for the construction, demolition, replacement, major repair, renovation, planning or design of real property and improvements thereon except where such work is for the beneficial use of the Contractor. Section 312 does not apply to: (i) work, goods or services unrelated to this contract; or (ii) employment outside New York State. The Authority will consider compliance by a Contractor or its subcontractor with the requirements of any Federal law concerning equal employment opportunity which effectuates the purpose of this section. The Authority shall determine whether the imposition of the requirements of the provisions hereof duplicate or conflict with any such Federal law, and if such duplication or conflict exists, the Authority may waive the applicability of §312 of the Executive Law to the extent of such duplication or conflict. The Contractor shall comply with all duly promulgated and lawful rules and regulations of the Department of Economic Development's Division of Minority and Women's Business Development pertaining thereto.

12. CONFLICTING TERMS. In the event of a conflict between the terms of the contract (including any and all attachments thereto and amendments thereof) and the terms of this Appendix A, the terms of this Appendix A shall control.

13. GOVERNING LAW. This contract shall be governed by the laws of the State of New York except where the Federal supremacy clause requires otherwise.

14. LATE PAYMENT. Timeliness of payment and any interest to be paid to the Contractor for late payment shall be governed by State Public Authorities Law §2880 and 21 NYCRR Part 109.

15. NO ARBITRATION. Disputes involving this contract, including the breach or alleged breach thereof, may not be submitted to binding arbitration (except where statutorily authorized) but must, instead, be heard in a court of competent jurisdiction of the State of New York.

16. SERVICE OF PROCESS. In addition to the methods of service allowed by the State Civil Practice Law & Rules, the Contractor hereby consents to service of process upon it by registered or certified mail, return receipt requested. Service hereunder shall be complete upon the Contractor's actual receipt of process or upon the Authority's receipt of the return thereof by the United States Postal Service as refused or undeliverable. The Contractor must promptly notify the Authority, in writing, of each and every change of address to which service of process can be made. Service by the Authority to the last known address shall be sufficient. The Contractor will have thirty (30) calendar days after service hereunder is complete in which to respond.

17. PROHIBITION ON PURCHASE OF TROPICAL HARDWOODS. The Contractor certifies and warrants that all wood products to be used under this contract will be in accordance with, but not limited to, the specifications and provisions of State Finance Law §165 (Use of Tropical Hardwoods) which prohibits purchase and use of tropical hardwoods, unless specifically exempted, by the State or any governmental agency or political subdivision or public benefit corporation. Qualification for an exemption under this law will be the responsibility of the Contractor to establish to meet with the approval of the Authority.

In addition, when any portion of this contract involving the use of woods, whether supply or installation, is to be performed by any subcontractor, the prime Contractor will indicate and certify in the submitted bid proposal that the subcontractor has been informed and is in compliance with specifications and provisions regarding use of tropical hardwoods as detailed in State Finance Law §165. Any such use must meet with the approval of the Authority; otherwise, the bid may not be considered responsive. Under bidder certifications, proof of qualification for exemption will be the responsibility of the Contractor to meet with the approval of the Authority.

18. MACBRIDE FAIR EMPLOYMENT PRINCIPLES. In accordance with the MacBride Fair Employment Principles (Chapter 807 of the Laws of 1992), the Contractor hereby stipulates that the Contractor either (a) has no business operations in Northern Ireland, or (b) shall take lawful steps in good faith to conduct any business operations in Northern Ireland in accordance with the MacBride Fair Employment Principles (as described in State Finance Law §165), and shall permit independent monitoring of compliance with such principles.

19. OMNIBUS PROCUREMENT ACT OF 1992. It is the policy of New York State to maximize opportunities for the

participation of New York State business enterprises, including minority and women-owned business enterprises as bidders, subcontractors and suppliers on its procurement contracts.

Information on the availability of New York State subcontractors and suppliers is available from:

NYS Department of Economic Development
Division for Small Business
30 South Pearl Street – 7th Floor
Albany, NY 12245
Phone: (518) 292-5220
Fax: (518) 292-5884
<http://www.esd.ny.gov>

A directory of certified minority and women-owned business enterprises is available from:

NYS Department of Economic Development Minority and Women's Business Development Division
30 South Pearl Street – 2nd Floor
Albany, NY 12245
Phone: (518) 292-5250
Fax: (518) 292-5803
<http://www.esd.ny.gov>

The Omnibus Procurement Act of 1992 requires that by signing this bid proposal or contract, as applicable, the Contractor certifies that whenever the total bid amount is greater than \$1 million:

(a) The Contractor has made reasonable efforts to encourage the participation of New York State Business Enterprises as suppliers and subcontractors, including certified minority and women-owned business enterprises, on this project, and has retained the documentation of these efforts to be provided upon request to the Authority;

(b) The Contractor has complied with the Federal Equal Opportunity Act of 1972 (P.L. 92-261), as amended;

(c) The Contractor agrees to make reasonable efforts to provide notification to New York State residents of employment opportunities on this project through listing any such positions with the Job Service Division of the NYS Department of Labor, or providing such notification in such manner as is consistent with existing collective bargaining contracts or agreements. The Contractor agrees to document these efforts and to provide said documentation to the Authority upon request; and

(d) The Contractor acknowledges notice that the Authority may seek to obtain offset credits from foreign countries as a result of this contract and agrees to cooperate with the Authority in these efforts.

20. RECIPROCITY AND SANCTIONS PROVISIONS. Bidders are hereby notified that if their principal place of business is located in a country, nation, province, state or

political subdivision that penalizes New York State vendors, and if the goods or services they offer will be substantially produced or performed outside New York State, the Omnibus Procurement Act 1994 and 2000 amendments (Chapters 684 and 383, respectively) require that they be denied contracts which they would otherwise obtain. Contact the Department of Economic Development, Division for Small Business, 30 South Pearl Street, Albany, New York 12245, for a current list of jurisdictions subject to this provision. NOTE: As of October 2019, the list of discriminatory jurisdictions subject to this provision includes the states of South Carolina, Alaska, West Virginia, Wyoming, Louisiana and Hawaii.

21. NON-PUBLIC PERSONAL INFORMATION. The Contractor shall comply with the provisions of the New York State Information Security Breach and Notification Act (General Business Law §899-aa; State Technology Law §208). In addition to any relief or damages that may be imposed pursuant to the provisions of this Act, the Contractor shall be liable for the costs imposed upon the Authority which are associated with breach of the Act if caused by Contractor's negligent or willful acts or omissions, or the negligent or willful acts or omissions of the Contractor's agents, officers, employees or subcontractors.

22. IRAN DIVESTMENT ACT. In accordance with State Public Authorities Law §2879-c, if this is a contract for work or services performed or to be performed, or goods sold or to be sold, the Contractor subscribes and affirms, under penalty of perjury, that: by signing this contract, each person and each person signing on behalf of any other party certifies, and in the case of a joint bid or partnership each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief that each person is not on the list created pursuant to paragraph (b) of subdivision 3 of §165-a of the State Finance Law, entitled "Entities Determined to be Non-Responsive Bidders/Offerers pursuant to the New York State Iran Divestment Act of 2012" ("Prohibited Entities List") posted at: <https://ogs.ny.gov/list-entities-determined-be-non-responsive-biddersofferers-pursuant-nys-iran-divestment-act-2012>.

For the purposes of this clause, the term "person" shall be as defined in subdivision (1)(e) of §165-a of the State Finance Law.

Contractor further certifies that it will not utilize on this contract any subcontractor that is identified on the Prohibited Entities List. Contractor agrees that should it seek to renew or extend this contract, it must provide the same certification at the time the contract is renewed or extended. Contractor also agrees that any proposed Assignee of this contract will be required to certify that it is not on the Prohibited Entities List before the contract assignment will be approved by the Authority.

During the term of the contract, should the Authority receive information that a person (as defined in State Finance Law § 165-a) is in violation of the above-referenced certifications, the Authority will review such information and offer the person an opportunity to respond. If the person fails to demonstrate that it has ceased its engagement in the investment activity which is in violation of the Act within 90 days after the determination of such violation, then the Authority shall take such action as may be appropriate and provided for by law, rule, or contract, including, but not limited to, imposing sanctions, seeking compliance, recovering damages, or declaring the Contractor in default.

23. OBSERVANCE OF LAWS. The Contractor agrees to observe all applicable Federal, State and local laws and regulations, and to procure all necessary licenses and permits.

24. NO WAIVER OF PROVISIONS. The Authority's failure to exercise or delay in exercising any right or remedy under this contract shall not constitute a waiver of such right or remedy or any other right or remedy set forth therein. No waiver by the Authority of any right or remedy under this contract shall be effective unless made in a writing duly executed by an authorized officer of the Authority, and such waiver shall be limited to the specific instance so written and shall not constitute a waiver of such right or remedy in the future or of any other right or remedy under this contract.

25. ENTIRE AGREEMENT. This contract, together with this Appendix A and any other appendices, attachments, schedules or exhibits, constitutes the entire understanding between the parties and there are no other oral or extrinsic understandings of any kind between the parties. This contract may not be changed or modified in any manner except by a subsequent writing, duly executed by the parties thereto.

26. ADMISSIBILITY OF REPRODUCTION OF CONTRACT. Notwithstanding the best evidence rule or any other legal principle or rule of evidence to the contrary, the Contractor acknowledges and agrees that it waives any and all objections to the admissibility into evidence at any court proceeding or to the use at any examination before trial of an electronic reproduction of this contract, in the form approved by the State Comptroller, if such approval was required, regardless of whether the original of said contract is in existence.

27. CERTIFICATION OF REGISTRATION TO COLLECT SALES AND COMPENSATING USE TAX BY CERTAIN STATE CONTRACTORS, AFFILIATES AND SUBCONTRACTORS. To the extent this agreement is a contract as defined by Tax Law § 5-a, if the Contractor fails to make the certification required by Tax Law § 5-a or if during the term of the contract, the Department of Taxation and Finance or the Authority, as defined by Tax Law § 5-a, discovers that the certification, made under penalty of perjury, is false, then such failure to file or false certification shall be a

material breach of this contract and this contract may be terminated, by providing written notification to the Contractor in accordance with the terms of the agreement, if the Authority determines that such action is in the best interest of the Authority.

28. CONTRACT INVOLVING STEEL PRODUCTS. Contracts involving steel products are subject to Public Authorities Law § 2603-a, and steel products to be provided or incorporated by Contractor must be produced or made in whole or substantial part in the United States as set forth therein.